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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*FOREST POLICY FOR THE FORESTED LANDS OF THE UNITED STATES.**

THE RESERVED FOREST LANDS OF THE PUBLIC DOMAIN.†

THE peculiar topographical and climatic conditions of western North America would appear to make the preservation of its forests essential to the profitable and permanent occupation of the country. The precipitation of moisture west of the one hundredth meridian is unequally distributed throughout the year; the summers are hot and dry, and the whole territory, with the exception of the coast region of the northwest, is watered so imperfectly that forests are restricted to the slopes of high mountain ranges or to elevated plains and mesas, the valleys of the interior and of all the south being practically treeless. In all the interior and southern regions precipitation is insufficient for certain and profitable cultivation, and permanent agricultural prosperity can only be assured through irrigation. Much of the region is traversed

* Extracts from the report of the committee appointed by the National Academy of Sciences, transmitted by the President to Congress on May 25th. The report is signed by the members of the committee —Charles S. Sargent, Henry L. Abbot, A. Agassiz, Wm. H. Brewer, Arnold Hague, Gifford Pinchot, Wolcott Gibbs. It is dated from Arnold Arboretum, Harvard University, May 1, 1897.

† In the first part of the report the importance of the conservation of forests is considered in the light of European studies and the forest administration of foreign countries is reviewed.

by lofty mountain ranges well wooded at the north and sparsely wooded at the south. Their forests serve to collect, and in a measure regulate the flow of streams, the waters of which, carefully conserved and distributed artifically, would render possible the reclamation of vast areas of so-called desert lands. Irrigation systems have been undertaken in many localities under State or corporate control and have been prosecuted until their value has been amply demonstrated, although the one essential condition of their permanent success, the preservation of the forests on high mountain slopes, has been entirely neglected.

Under the authority of Section 24 of the Act of Congress, approved March 3, 1891, by which the President of the United States can withdraw from sale and entry and set apart as forest reservations parts of the public domain, whether wholly or in part covered with timber, seventeen forest reserves, with a total estimated area of 17,500,000 acres, were established prior to 1894. During the journey made by your committee last summer through the Western States and Territories it became impressed with the importance of extending this reserved area before further encroachments were made on the public domain; and on its return it prepared a short preliminary report, recommending the establishment of thirteen additional forest reserves with an estimated total area of 21,378,840 acres and roughly designating their boundaries. On the 6th of February this report was submitted by the Secretary of the Interior to the President, who, on the 22d of February, issued proclamations making the recommendations of your committee effective.

Fire and pasturage chiefly threaten the reserved forest lands of the public domain. In comparison with these the damage which is inflicted on them by illegal timber cutting is insignificant. Timber can only be cut profitably when the operation is conducted on a comparatively large scale; and large operations require roads and sawmills, and consequently the use of capital, and are usually easy to detect and arrest. The cutting of timber on the unreserved public lands under cover of bad laws or without a pretense of legal sanction causes, as we shall show later, serious losses to the government, but so far as we have been able to observe it does not now seriously menace many of the reserves.

Fires are particularly destructive to the forests of western North America. These are composed almost exclusively of highly resinous trees, which, when they grow beyond the influence of the moisture-laden air currents from the Pacific Ocean, ignite easily, and, burning fiercely on the surface, are quickly killed, while the flames sweep forward, leaving standing behind them the dead, although unconsumed, trunks to furnish material for later conflagrations and to intensify their heat. The climate, with its unequally distributed rainfall and intensely hot and dry summers and the peculiarly inflammable character of the forests, make forest fires in the West numerous and particularly destructive, and no other part of the country has suffered so seriously from this cause.

Nomadic sheep husbandry has already seriously damaged the mountain forests in those States and Territories where it has been largely practiced. In California and western Oregon great bands of sheep, often owned by foreigners, who are temporary residents of this country, are driven in spring into the high Sierras and Cascade ranges. Feeding as they travel from the valleys at the foot of the mountains to the the upper alpine meadows, they carry desolation with them. Every blade of glass, the tender, growing shoots of shrubs, and seedling trees, are eaten to the ground. The feet of these 'hoofed locusts,' crossing and

recrossing the faces of steep slope, tread out the plants sheep do not relish and, loosening the forest floor, produce conditions favorable to floods. Their destruction of the undergrowth of the forest and of the sod of alpine meadows hastens the melting of snow in spring and quickens evaporation.

The pasturage of sheep in mountain forests thus increases the floods of early summer, which carry away rapidly the water that under natural conditions would not reach the rivers until late in the season, when it is most needed for irrigation, and by destroying the seedling trees, on which the permanency of forests depends, prevents natural forest reproduction, and therefore ultimately destroys the forests themselves. In California and Oregon the injury to the public domain by illegal pasturage is usually increased by the methods of the shepherds, who now penetrate to the highest and most inaccessible slopes and alpine meadows wherever a blade of grass can grow, and before returning to the valleys in the autumn start fires to uncover the surface of the ground and simulate the growth of herbage. Unrestricted pasturing of sheep in the Sierras and southern Cascade forests, by preventing their reproduction and increasing the number of fires, must inevitably so change the flow of streams heading in these mountains that they will become worthless for irrigation.

A study of the forest reserves, in their relations to the general development and welfare of the country, shows that the segregations of these great bodies of reserved lands can not be withdrawn from all occupation and use, and that they must be made to perform their part in the economy of the nation. According to a strict interpretation of the rulings of the Department of the Interior, no one has a right to enter a forest reserve, to cut a single tree from its forests, or to examine its rocks in search of valuable minerals. Forty million acres of land are thus theoretically shut out from all human occupation or enjoyment. Such a condition of things should not continue, for unless the reserved lands of the public domain are made to contribute to the welfare and prosperity of the country they should be thrown open to settlement and the whole system of reserved forests abandoned. Land more valuable for its mineral deposits, or for the production of agricultural crops, than for its timber should be taken from the reservations and sold to miners and farmers; the mature timber should be cut and sold; settlers within or adjacent to the boundaries, unable to procure it in other ways, should be authorized to take such material from reserved forests as is necessary for their needs, and prospectors should be allowed to search them for minerals.

But it must not be forgotton that the public domain of which these reserves form a part belongs to the people of the whole country, and not to those of any one section. It is right, therefore, that the forest reserves should be managed for the benefit of the people of the whole country, and not for any particular class or section. Steep and elevated mountain slopes should not be cleared of their forests for the sole benefit of the prospector or the miner, because this by its influence on water flow might mean permanent injury to persons living hundreds of miles away. A few foreign sheep owners should not be allowed to exterminate great forests at the expense of the whole country, and prospectors and miners should not be permitted to burn willfully or carelessly forests in which all classes of the community are equally interested.

Our examination of the Western forests shows that the existing methods and forces at the disposal of the Interior Department are entirely inadequate to protect the for-

ests of the public domain. Civil employees, often selected for political reasons and retained in office by political favor, insufficiently paid and without security in their tenure of office, have proved unable to cope with the difficulties of forest protection, and the reserves are practically unguarded. Excluded from the provisions of the general land laws and without protection, they invite trespass of every kind and demoralize without benefiting the community. It is evident that if the government proposes to protect public property in the reserves and to enforce any laws or regulations which may be enacted for their administration, the assistance of the military must be called in until an organization can be developed in the Interior Department for the protection, management and improvement of all reserved government forest lands; for without such assistance the experience of the past clearly shows that it is idle to hope that fires can be restricted, pasturage abolished and timber cutting and mining regulated in the reserves; and if this can not be done their forests will sooner or later be ruined and the objects defeated for which they have been established.

PROPOSED SYSTEM OF FOREST ADMINISTRATION.

It has been shown that the preservation and judicious management of the forests on those portions of the public domain which are unsuited for agriculture are of great importance for the flow of rivers needed for the irrigation of arid districts, and to furnish forest products for settlers on adjacent arable lands, and for mining operations. The cheapness of forest products in the United States, and the length of time required to produce crops of timber in the West, will make the investment of the capital of individuals in silvicultural operations, for the present at least, a doubtful enterprise in those States and Territories where the public domain is now principally situated; and silviculture in western North America will only be really successful under sustained government control and administration; for, dealing with crops which often do not reach maturity until the end of one or two centuries, it can only be made profitable by carrying out without interruption and under thoroughly trained officers, plans which must often be followed during the lives of several generations of men. This stability and continuity of management can only be secured by a permanent government administration composed of officers of the highest character, entirely devoted to duty.

Annual taxes on the land of individuals demand annual income; and to avoid or meet this burden of taxation land which should always remain covered with forests is often denuded before the requirements of commerce justify it, or is devoted to uses for which it is ill adapted. Private ownership, for example, of the redwood-bearing land of the California coast region, the most productive forest land in the world, has resulted in this land, which should remain covered with forest for all time, being rapidly converted into indifferent pasturage. The fee of lands which are most valuable for the production of timber should remain vested in the general government, and these lands, if they are managed wisely, can be made to supply forest material indefinitely to the agricultural and mining populations of adjacent districts and to improve in productiveness and value.

Ultimate self-support of a government forest administration is possible in the United States, and it may be expected to yield a permanent income if the national forests are managed with the intelligence, thrift and honesty which characterize the forest administration in Germany, France and other European countries. At first, however, the cost of administration will

exceed the receipts, as is almost invariably the case in important economic reforms, but outlays may be expected to diminish in proportion as the administration is faithful, intelligent and honest.

To inaugurate at once a complete system of forest administration would be to attempt more than is wise or feasible at this time; but the necessity of prompt action for the protection of the forest reserves from fire, illegal pasturage and other depredations is urgent, and efficient temporary police measures are needed immediately. A plan for the temporary care of the forest reserves may be wisely based on the experience gained in the management of the national parks. This clearly shows that it is possible to protect forests in the most exposed and difficult parts of the public domain with small bodies of troops; whereas, before soldiers were detailed to police the Yellowstone National Park, all efforts to manage it by civil officers of the government had shown the futility of any attempts at control which did not rest on the moral and physical support of the army.

The primary object of such temporary management would not be to produce a revenue, but to protect the reserves against fire and depredation. It should be the duty of the superintendents to issue passes to persons desirous of entering or crossing them, and to keep a careful record of the names and residences of all such persons. Sheep should be wholly excluded from the reserves, and cattle should be admitted only in moderate numbers and when the property of actual settlers on adjacent lands.

The fundamental principle of any government system of forest management should be the retention of the fee of forest lands, and the sale of forest products from them at reasonable prices, under regulations looking to the perpetual reproduction of the forest. While it is not desirable, perhaps, that the government in the immediate future should enter into competition with the private owners of forest lands, it is evident that ultimately the sale of forest supplies from the government timber lands should not only cover all expenses of government forest management, but produce a steadily increasing income.

Upon officers charged with the administration of the government forests will devolve the care of immensely valuable public property, its improvement under the best established scientific methods, police responsibility of exceptional delicacy, surveys, the construction of roads and engineering works for the protection of mountain slopes, and the control of numerous agents widely separated and not easily trained to habits of discipline. Many of these duties are essentially military in character, and should be regulated for the present on military principles. Wise forest management calls for technical knowledge which must be based on a liberal scientific education. The forest officers must be men of the highest personal character, who can be trusted to avoid participation in any private business connected, however remotely, with forest products. To secure the service of men qualified to meet these several requirements will call for liberal remuneration and permanent tenure of office.*

Topographical and economic surveys upon which it would have been possible to establish scientifically the proper boundaries of the reserved lands do not exist and their limits have been laid down roughly with the idea that they would be modified as soon as it was possible to determine accurately what portions were more valuable for the production of minerals and for agriculture and grazing than for their timber

*A plan for a permanent organization is then recommended, a bill to protect and administer public forest reserves being given in an appendix.

growth, and that such lands would then be opened to entry and settlement. In all the forest reserves visited by your committee it saw opportunities to improve their boundaries and found lands which can not be permanently reserved without inflicting serious hardships and losses on the community. Only a small portion of the White River Plateau Timber Land Reserve in Colorado, for example, is forest land, the remainder being covered with grasses and scattered clumps of oak bushes. Such land is, of course, most valuable for pasturage, and its withdrawal from use cripples the important cattle industry of the region. In the Washington Forest Reserve and in the Cascade Forest Reserve are mineral deposits which can not wisely be held from entry, and near the borders of others there are lands more valuable for agriculture or fruit growing than for other purposes.

It is evident that such lands should be taken from the forest reserves as soon as it is practicable to do so, but before this can be done safely those parts of the public domain which have been reserved, or which may be reserved, should be accurately surveyed and carefully mapped. As the United States Geological Survey is the only Bureau in the Department of the Interior equipped for this work, it can probably most conveniently make these surveys. Their proper interpretation is a matter of the greatest importance, for on the men who undertake it will devolve the duty of establishing the final boundaries of the reserved forest lands of the public domain. Enormous interests are involved in these final decisions, and this work can be entrusted only to men of the highest integrity, intelligence and public spirit. Efforts will certainly be made to improperly influence their judgment, and they will be subjected to severe temptations. The power to open any part of the reserved lands to settlement is in the hands of the President of the United States, but he will necessarily base his decisions in such matters on the reports and recommendations of the experts who are to study the results of the surveys made under the direction of the Geological Survey.

To provide for this important duty, we recommend that the President be authorized to appoint a commission to be known as the board of forest lands, to consist of an officer of the Engineer Corps of the Army, a member of the Geological Survey, a member of the Coast Survey and two persons not connected with the public service, and that it shall be the duty of this board to determine, with the aid of actual surveys and such other examinations as may be found necessary, the boundaries of those parts of the public domain which should be retained permanently by the government as forests, and that upon its recommendations the President should be authorized to open all other lands to entry and sale. It is believed that the character of this commission can be best maintained at the highest level by limiting the remuneration of the two members unconnected with government service to their actual expenses.

In all the forest reserves individuals have acquired more or less perfect title to land, and as they may claim that their rights are interfered with, or the value of their holdings diminished by the reservation from entry of adjacent lands, opportunity should be given them to exchange on an equitable basis their lands or rights for those of similar character outside the reservations. Several of the forest reserves are within the limits of land grants made to railroad corporations, and it should be possible for the Secretary of the Interior to arrange with these corporations to exchange their holdings within the reservations for similar unreserved lands.*

* A section on the unreserved forest lands of the public domain shows the harm that has resulted from the working of the land laws.

ADDITIONAL NATIONAL PARKS.

Parts of two forest reserves contain features of supreme natural beauty, and can best be preserved for the enjoyment and instruction of the world by creating them national parks and governing them under the rules and regulations which have proved successful in protecting the Yellowstone National Park. The first of these is the upper slopes of Mount Ranier, in Washington, with its glaciers, its alpine meadows clothed with flowers, and the fringe of forest which maintains a precarious foothold on the steep ridges below the line of its perpetual snows. This mountain is one of the highest and most beautiful in North America, and outside Alaska its glaciers are unrivaled in magnitude and interest in the United States. Memorials have been presented to Congress by the American Association for the Advancement of Science, the Geological Society of America, the Sierra Club and the Apalachian Mountain Club favoring the establishment of this national park, and an act setting aside certain lands for it was passed by the Fifty-fourth Congress at its second session; but the bill, by extending to it the mineral-land laws, might have destroyed its scenic value, and it did not receive Executive sanction.

The second spot which we believe should be made into a national park is that portion of the Grand Canyon Reserve in Arizona which is immediately adjacent to and includes the walls of the canyon itself. These two localities, Mount Ranier in Washington and the Grand Canyon of the Colorado in Arizona, are each in its particular way unsurpassed in interest. Their natural wonders should be preserved without further defacement than is necessary to make them easily accessible to the people; and unless mining is prohibited in their immedite neighborhood, and unless they can be strictly guarded against fires, their scenic value will be seriously impaired. As this protection can only be secured by the adoption of the rules and regulations similar to those which govern the national parks, we recommend the establishment of a Ranier national park and a Grand Canyon national park.

CONCLUSIONS AND RECOMMENDATIONS.

The Secretary of the Interior, in his letter of February 15, 1896, asked the Academy whether "it is desirable and practicable to preserve from fire and to maintain permanently as forest lands those portions of the public domain now bearing wood growth for the supply of timber."

Your committee is of the opinion that it is not only desirable but essential to national welfare to protect the forested lands of the public domain, for their influence on the flow of streams and to supply timber and other forest products; and that it is practicable to reduce the number and restrict the ravages of forest fires in the Western States and Territories, provided details from the Army of the United States are used for this purpose permanently, or until a body of trained forest guards or rangers can be organized. It does not believe that it is practicable or possible to protect the forests on the public domain from fire and pillage with the present methods and machinery of the government.

In answer to the second question submitted by the Secretary of the Interior, "How far does the influence of forests upon climate, soil, and water conditions make desirable a policy of forest conservation in regions where the public domain is principally situated?" It is the opinion of your committee that, while forests probably do not increase the precipitation of moisture in any broad and general way, they are necessary to prevent destructive spring floods, and corresponding periods of low water in summer and autumn when the agriculture of a large part of western

North America is dependent upon irrigation.

The answer to the third question, "What specific legislation should be enacted to remedy the evils now confessedly existing?" will be found in the series of proposed bills appended to this report. They present the following recommendations:

1. That the Secretary of War, upon the request of the Secretary of the Interior, shall be authorized and directed to make the necessary details of troops to protect the forests, timber and undergrowth on the public reservations, and in the national parks not otherwise protected under existing laws, until a permanent forest bureau in the Department of the Interior has been authorized and thoroughly organized.

2. That the Secretary of the Interior shall be authorized and directed to issue the necessary rules and regulations for the protection, growth and improvement of the forests on the forest reserves of the United States; for the sale from them of timber, firewood and fencing to actual settlers on and adjacent to such reserves, and to the owners of mines legally located in them for use in such mines; for allowing actual settlers who have no timber on their own claims to take from the reserves firewood, posts, poles and fencing material necessary for their immediate personal use; for allowing the public to enter and cross the reserves; for granting to county commissioners rights of way for wagon roads in and across the reserves; for granting rights of way for irrigating ditches, flumes and pipes, and for reservoir sites; for permitting prospectors to enter the reserves in search of valuable minerals; for opening the reserves to the location of mining claims under the general mineral laws; and for allowing the owners of unperfected claims or patents, and the land-grant railroads with lands located in the reserves, to exchange them under equitable conditions for unreserved lands.

3. That a bureau of public forests shall be established in the Department of the Interior, composed of officers specially selected with reference to their character and attainments, holding office during efficiency and good behavior and liberally paid and pensioned.

4. That a board of forest lands shall be appointed by the President to determine from actual topographical surveys to be made by the director of the Geological Survey what portions of the public domain should be reserved permanently as forest lands and what portions, being more valuable for agriculture or mining, should be open to sale and settlement.

5. That all public lands of the United States more valuable for the production of timber than for agriculture or mining shall be withdrawn from sale, settlement and other disposition and held for the growth and sale of timber.

6. That certain portions of the Rainier Forest Reserve in Washington and of the Grand Canyon Forest Reserve in Arizona shall be set aside and governed as national parks.

THE AMERICAN PHYSIOLOGICAL SOCIETY.

THE fourth special meeting of the American Physiological Society was held in Washington, D. C., on May 4, 5 and 6, 1897, in conjunction with the fourth Congress of American Physicians and Surgeons. The sessions were held at the Columbian University. The following communications were presented and discussed:

A new form of Gastric Cannula. W. T. PORTER.

Phlorhizin Diabetes in Dogs. G. LUSK.

The continued frequent administration of phlorhizin to dogs produces in them a form of diabetes in which, during starvation or meat nutrition, sugar is eliminated in the

urine in the average proportion of 3.75 g. to every one gram of nitrogen. If we neglect the small quantity of nitrogen in the fæces, this means that for every 6.25 g. of proteid destroyed in the body 3.75 g. of sugar may be obtained, or sixty per cent. of sugar from the proteid molecule. This sugar is completely fermentable with yeast; it is only very slightly affected by boiling with 10% hydrochloric acid, and it rotates polarized light as does dextrose. If dextrose be fed to dogs suffering from this form of diabetes, it is almost quantitatively eliminated in the urine. If levulose and galactose be fed, dextrose appears in increased quantity in the urine, but no levulose or galactose. The production of phlorhizin diabetes in starving dogs may cause an increased proteid metabolism of four hundred and fifty per cent.

Further Contributions to the Physiology of Deglutition. S. J. MELTZER.

Kronecker and Meltzer have advanced the view, on the basis of convincing experiments, that in the act of deglutition fluids and semi-solids are not carried down by peristalsis, but are rapidly squirted down the œsophagus by the rapid contraction especially of the mylohyoid muscles. After M. discovered the presence of the 'squirting murmur' opposite the cardia about six seconds after the beginning of deglutition, the authors supplemented their view by the assumption that the fluid remains above the cardia until it is carried into the stomach by the peristaltic wave. In support of this latter view, which was contradicted by some writers, Meltzer reported some experimental observations. In rabbits and dogs the cardiac aperture of the stomach was directly observed while the deglutition was going on, and it was found that the entire swallowed mass was carried into the stomach by peristalsis only. Furthermore, by the removal of a few ribs and by the introduction of a 'speculum' into various parts of the thorax the behavior of the entire thoracic œsophagus during deglutition could be satisfactorily scrutinized. Meltzer summarizes his observations as follows: During each act of deglutition liquid and air are rapidly squirted down into the œsophagus to a point about half way between the bifurcation of the trachea and the diaphragm and remain there until the peristaltic wave carries them down into the stomach.

Movements of the Alimentary Canal. H. P. BOWDITCH.

This paper was a brief preliminary report upon the results of some experiments performed in the laboratory of the Harvard Medical School by Messrs. A. Moser and W. B. Cannon, medical students, on the movements of the alimentary canal as studied by means of the X-rays and a fluorescent screen.

For this purpose moist bread, meat, mush or viscid fluids were mixed with subnitrate of bismuth. Food thus prepared is visible during the process of deglutition, and, if given in sufficient quantities, serves to outline the stomach and to render its peristaltic movements visible. Observations on a goose showed that a bolus of such food, swallowed without water, moved slowly and regularly down the œsophagus. There was no evidence of squirting. The movement was slower in the lower part of the neck. When water was given with the boluses the movement was irregular. Viscid fluids were swallowed in the same peristaltic way.

Experiments with a cat showed that a bolus of meat moved down the œsophagus regularly with no interruption or shooting movement. In the neck and from the level of the apex of the heart to the stomach the rate was lower than in the intermediate region. When water was added, the bolus shot down at irregular intervals, but at the level of the apex of the heart the rate

always slackened and the bolus moved slowly into the stomach. Thin mush and viscid fluids were also carried down by peristalsis. Large boluses stopped in the lower half of the thorax with each expiration, and descended with each inspiration. The examination of a cat's stomach filled with food mixed with subnitrate of bismuth showed the occurrence of a constriction at about the middle of the organ, which slowly moved towards the pylorus and was followed by other peristaltic waves at intervals of about ten seconds. The food thus pressed onward toward the pylorus did not pass into the duodenum, but returned apparently through the central portion of the organ, since the wave of constriction was never sufficient to obliterate the whole cavity.

The Reaction of some Animal Fluids. R. H. CHITTENDEN.

There is a general assumption on the part of physiologists that the alkaline reaction obtained with red litmus, in the case of many animal fluids, is due in great part to the presence of sodium carbonate. In many cases this assumption is quite erroneous. Thus, a large number of examinations of fresh bile from many species of animals shows that the fluid never contains any sodium carbonate; although alkaline to red litmus, the fluid is invariably acid toward phenolphthalein, 1 gram of bile requiring on an average 0.4 milligram NaOH to neutralize the free acid or acid salts present. With lacmoid, however, the reaction is invariably alkaline, thus showing the absence of free acids. The salts Na_2HPO_4 and NaH_2PO_4 undoubtedly play an important part in determining the behavior of the bile toward different indicators. As a rule, 5 c.c. of fresh ox bile require 0.5 c.c. of $\frac{1}{10}$ normal NaOH solution to render the fluid neutral to phenolphthalein and about 3.0 c.c. of $\frac{1}{10}$ normal HCl solution to make the fluid neutral to lacmoid.

Human mixed saliva is likewise acid to phenolphthalein; on an average 5 c.c. of filtered saliva require 0.6 c.c. of $\frac{1}{10}$ normal NaOH solution to render the fluid neutral to phenolphthalein. Toward most other indicators the fluid reacts alkaline, viz., with rosolic acid, litmus, lacmoid, congo red, alizarin, etc.

The submaxillary saliva of the dog, however, obtained on stimulation of the chorda tympani, is faintly alkaline to phenolphthalein, but 5 c.c. of the fluid generally require 1.3 c.c. of $\frac{1}{10}$ normal HCl solution to render the fluid neutral to litmus and lacmoid. Succus entericus and pancreatic juice undoubtedly owe their alkalinity in great part to the presence of sodium carbonate and bicarbonate.

The Proteolytic Action of Papain. R. H. CHITTENDEN.

The results of some quantitative experiments made by Mr. McDermott, designed to throw light upon the relative peptone-forming power of papain, were reported. The following experiment with coagulated egg-albumen, in the presence of 0.25 per cent. Na_2Co_3 and chloroform at 40°C., may serve as an illustration of the character of the results.

	24 hours digestion.	48 hours digestion.
Undissolved residue (mostly antialbumid)	35.8 per cent.	32.8 per cent.
Neutralization precipitate	1.7 "	0.9 "
Proteoses	26.7 "	24.3 "
Peptones	35.8 "	42.0 "

Especially noticeable is the behavior of deutero-albumose as formed by papain, when injected into the blood of a dog, in the proportion of 0.5 gram albumose per kilo of body weight. Unlike the corresponding albumose formed in gastric digestion, this substance does not appear to affect blood pressure, neither is there any noticeable effect upon the temperature of the body. Coagulation of the blood, however, is somewhat retarded, although not to the same extent as with ordinary deutero-

albumose. Diuresis, on the other hand, is very marked and in fifty minutes after the injection of the albumose fully 50 per cent of the substance is found in the urine which rapidly accumulates in the bladder. On removing the albumose from the urine by saturation of the fluid with ammonium sulphate a strong reaction for true peptone can be obtained, thus showing that in the elimination of the albumose from the body a certain amount of the substance is transformed into peptone, presumably in the epithelial cells of the kidney.

A Search for Pexin. J. W. WARREN.

The presence of pexin, the milk curdling ferment (otherwise 'labferment,' or 'rennin') in the digestive apparatus of non-mammalian vertebrates has been fully demonstrated. In the Bryn Mawr laboratory investigations have been made by various students which help to make more probable the opinion that there is no vertebrate in which the curdling ferment does not exist. A similar substance is known to occur in many plant juices and also in certain microorganisms. This wide distribution of such a peculiar material or materials raises interesting questions as to its significance and also concerning the value of the clotting of milk as incidental to the digestive process.

Does such a ferment exist among invertebrates? Some little time ago the stomachs of a few lobsters were examined in the Bryn Mawr laboratory. Chloroform extracts were prepared and were found to have no curdling action, nor were they made active by acidulation and subsequent neutralization in the usual manner. When neutralized with calcium carbonate (which is probably equivalent to the addition of soluble calcium compounds) the liquid acquired the power of clotting milk. Recently the question has been taken up again. Fresh earthworms were carefully washed, chopped into fine pieces and extracted by chloroform water. This infusion was inert, but became active after treatment which is known to transform the zymogen. In another series the digestive tract was isolated, opened and thoroughly washed, and then put into chloroform water. This extract could not be made to coagulate milk by any of the methods which are ordinarily successful for the demonstration of pexin or its forerunner, pexinogen. This divergence may be due to the accidental exhaustion of the glands in the second series, or perhaps to the presence of bacteria in the contents of the digestive canal of the first lot of worms. Other less probable explanations might be given. The digestive apparatus of oysters and clams has also been examined in a preliminary way, but thus far only with quite negative result.

Note upon the Physiological Effects of Injections of Extracts of the Hypophysis Cerebri. W. H. HOWELL. Read by title.

Extracts were made of the glandular or anterior lobe of the hypophysis cerebri and the posterior or infundibular lobe, and the effects were tested separately by injections into the circulation of dogs under the influence of various narcotics. Usually the extracts were made by rubbing up the portion used in a few drops of glycerine and diluting this mixture, after it had stood several hours, with a greater or less quantity of normal saline. It was found that extracts thus made of the glandular lobe have no distinct or constant effect on the circulatory organs, while the extracts of the infundibular lobe have a marked influence on the heart rate and blood pressure. When the vagi were intact this effect consisted usually in a rise of pressure, followed quickly by a temporary fall during which the heart rate remained unchanged or showed some acceleration, and this was followed by very slow and powerful heart beats lasting from a few minutes to half an hour or more, during which the pressure

rose gradually to a maximum above the normal pressure and then declined more slowly. In these experiments the maximum rise of pressure varied from 20 to 60 mms. Hg. and the maximum reduction in pulse rate varied from 40 to 60 per cent. of the rate existing before the injection. When the vagi were cut, or the animal was atropinized, the injections caused a rise of pressure, followed in some cases by a temporary fall, and then a more gradual but pronounced rise, together with a slower and more powerful heart beat. Under these conditions the maximal rise of pressure varied from 50 to 90 mm. Hg., while the maximal slowing of the pulse ranged from 17 to 35 per cent. of the rate before injection. Animals deeply under ether alone behaved in this respect like animals with the vagi cut. The slowing of the heart caused by extracts of the infundibular lobe seems, therefore, to be due in part to an effect upon the cardio-inhibitory center and in part to a peripheral effect, differing in this latter respect from suprarenal extracts. The effect upon the blood pressure seems to be due mainly to a peripheral effect, since it can be obtained readily in animals with the cord severed from the medulla and with part of the thoracic cord extirpated. As compared with extracts of the suprarenal bodies the effect of these extracts are characterized by their long duration, and the longer interval of time that must be allowed in order to obtain a similar effect from a second injection.

A Contribution to the Physiology of the Suprarenal Capsules. G. P. Dreyer.

The most striking effects of the injection of extracts of the suprarenals into blood vessels are general vaso-constriction with rise of blood pressure, slowing of pulse with intact vagi, and acceleration of pulse with vagi cut or paralyzed by atropin. Is the active substance contained in such extracts a product of the normal activity of the gland cells, *i. e.*, a true internal secretion, or the result of post-mortem changes? If the former a greater amount of it would be contained in blood coming direct from the gland than in blood taken from some other systemic vein, and this increase might be detected by the effects produced by intravenous injections of adrenal blood as compared with the effects of similar injections of blood from other veins. The author has made a series of such experiments on ten anæsthetized dogs. Femoral blood and adrenal blood were alternately injected into the jugular vein in quantities ranging from 5 c.c. to 40 c.c., either into the same animal from which it had been taken or into a fresh animal. In every case the adrenal blood gave an appreciable rise of pressure, in some cases exceeding 40 per cent., while the inhibition of the heart before section of the vagi, or the acceleration after atropine injection, were practically constant phenomena. The variation in the extent of the effects must probably be ascribed to differences in the secretory activity of the gland in the different dogs. Furthermore, in general, the effect was greater the slower the outflow from the adrenal vein, and apparently greater when the injection was into a dog other than the one yielding the adrenal blood. Blood from the femoral vein gave negative results.

Gases of the Blood during Nitrous Oxide Anæsthesia. G. T. Kemp.

The author's previous experiments have shown that when enough air or oxygen is mixed with nitrous oxide to keep an animal alive, anæsthesia can be maintained for a considerable length of time without risk of life to the animal. When nitrous oxide is replaced by nitrogen, the anæsthesia passes off. This shows that nitrous oxide possesses specific anæsthetizing properties not possessed by nitrogen.

A more thorough knowledge of the condition of the system during nitrous oxide

anæsthesia has been obtained by drawing blood for analysis while the animal was connected with a kymograph and breathing N_2O + air or N_2O + pure oxygen. The analysis of the blood gases shows that even when the animal was so deeply anæsthetized as to endure stimulation of a sensory nerve without pain the blood contained enough oxygen to support life. The CO_2 in the blood was greatly diminished. The average amount of N_2O in the blood during anæsthesia was 28 vols. per cent. (gas at 0° C. and 760 mm.). A study of the respiratory exchange indicates that the metabolism was lowered and that the system adapted itself to the small amount of oxygen present in the inspired air. The theory frequently found in text-books that nitrous oxide anæsthetizes solely by asphyxia is erroneous, and the safety of nitrous oxide compared with chloroform or ether merits that nitrous oxide, properly mixed with oxygen, be given a wider trial even in major surgery.

On the Production of Idioventricular Rhythm in the Mammalian Heart. A. R. CUSHNY.

The method employed was the stimulation of the ventricle in the dog by single induction shocks at a definite point in the relaxation. As a general rule the ventricular rhythm was accelerated, and both contraction and relaxation became imperfect. Not infrequently, however, the ventricular systole was stronger during stimulation than before and afterwards, and this was explained as being due to the dislocation of the auriclo-ventricular rhythm. In the great majority of cases the auricle assumed the accelerated ventricular rhythm, and the auricular systole became remarkably weak. This weakness is due in part to the acceleration of the rhythm, in part to the fact that the auricle contracts while the ventricle is in full contraction and has, therefore, to work against much greater resistance than normally.

The Cause of the Heart Beat. W. T. PORTER.

Any part of the dog's ventricle, even the apical fourth, will contract rhythmically, when cut away from the remainder of the ventricle and fed with warmed, defibrinated dog's blood through a cannula placed in the coronary artery ramifying in the extirpated part. Hence: (1) the cause of the rhythmic contraction of the ventricle lies within the ventricle itself; (2) the cause of the rhythmic contraction is not in a single localized coordination center; (3) the coordination mechanism, whatever it may be, is present in all parts of the ventricle; (4) the integrity of the whole ventricle is not essential to the coordinated contraction of a part of the ventricle; (5) assuming the correctness of the general belief in the absence of nerve cells from the apical half of the ventricle, the rhythmic coordinated contraction of the ventricle is not dependent on nerve cells.

A thin piece of the beating ventricle of the dog's heart *in situ* in the living animal may be partly severed from the apical portion in such a way that the isolated piece remains attached to the remainder of the ventricle only by its nutrient vessels, all muscular connections being cut. The heart and the isolated piece continue to contract. On slowing the heart by vagus excitation, the rhythmical contractions of the isolated piece may be watched without difficulty. Their rhythm then differs from that of the remainder of the heart. It follows that the rhythmic contractions of the isolated mammalian apex are not due to changes in the blood during its defibrination.

The Recovery of the Mammalian Heart from Fibrillary Contractions. W. T. PORTER.

Recovery of the dog's heart, or of any isolated part of it, from strong fibrillation produced either by electrical stimulation, mechanical insult, or sudden deprivation of blood supply, is secured by feeding the part with defibrinated dog's blood through its coronary artery.

On the Relation between the Beat of the Ventricle and the Flow of Blood through the Coronary Arteries. W. T. Porter.

When an isolated piece of dog's or cat's ventricle is fed through the coronary artery, the flow from the veins is seen to be greater during systole than during diastole. In an extirpated heart, supplied with blood at a constant pressure through the coronary arteries, a pulse synchronous with the systole may be observed in the superficial auricular veins before and after their connection with the coronary sinus is severed. A similar but less marked pulse can be demonstrated in the coronary arteries. When a vein on the surface of a dog's ventricle *in situ* in the living animal is incised, and the heart slowed by vagus excitation, the flow from the cut vein is much increased during ventricular systole. These observations show that the contraction of the cardiac muscle compresses the veins, and to a less extent the arteries, in the substance of the heart. The systole must, therefore, facilitate the circulation through the heart muscle. The minimum manometer fails to show a negative pressure in the coronary arteries. The ventricle acts on the coronary circulation as a force pump, and not, to any noticeable extent, as a suction pump.

The Circulation through the Vessels of Thebesius. W. T. Porter (for F. H. Pratt).

In nearly all experiments the freshly excised heart of the cat has been used. The auricles are tied off from the ventricles, and both coronary arteries ligated. A large cannula is introduced into the right ventricle through the pulmonary artery and secured by a ligature. This cannula is now supported vertically, so that the heart shall hang from its lower end, and defibrinated blood poured in from the top, so as to fill the ventricle and rise in the cannula to a height of several inches. The ventricle distends, and all the coronary veins become filled with blood; the coronary arteries remain empty. The ventricle begins to contract rhythmically, slowly at first, but gradually attaining the normal rate. Suspending the heart in warm normal saline solution facilitates the action. The blood within the ventricle and in the veins becomes venous, and, if contractions are to be sustained, must periodically be renewed. If a vein is opened, a small but steady outflow of blood occurs. Increasing the load beyond that furnished by a blood column of four or five inches lowers the force of contraction. Contractile activity may be kept up by this method for some time. Eight hours after excision is the maximum duration so far obtained, and in this case the ventricle was still active when left.

The experiments above described indicate plainly a nutritive phenomenon; the blood becomes reduced, and must be renewed in order to sustain contraction. That the contractions are not due to mere mechanical stimulus is proved by the fact that Ringer's solution fails to carry on the process. A genuine circulation exists between the ventricular cavity and the coronary veins through the vessels of Thebesius. The possibility of a nutrition from the ventricles direct may serve to explain some cases in which thrombosis or other stoppage of the coronary arteries has failed to destroy the normal activity of the heart. This method of nutrition bears a strong resemblance to that found in the frog.

The Innervation of the Heart of the Opossum (Didelphys virginiana). Reid Hunt (with D. W. Harrington). Read by title.

(1) *Vagus.* Standstill of the heart is easily produced by stimulation of the peripheral end of the vagus; the duration of the standstill is greater than that usually observed in other mammals. The heart beats slowly for some time after the cessation of the stimulus, *i. e.*, there is a long after-effect. By continuous weak stimula-

tion of the vagus the heart can be kept beating at a remarkably slow rate for some time and yet the blood pressure remain near or even rise above the normal.

(2) *Depressor.* In most cases there is a separate depressor nerve; it is usually formed by two roots, one from the superior laryngeal nerve, and the other from the ganglion of the trunk of the vagus. Stimulation of this nerve gives results entirely similar to those observed in the rabbit, *viz.*, fall of blood pressure and a reflex slowing of the heart.

(3) *Accelerator nerve.* The anatomical relations of these nerves resemble in general those found on the dog; stimulation of them causes marked increase in the heart rate and very frequently irregularity of the ventricles from their failure to follow all the auricular beats. Stimulation of the accelerators while the heart is being slowed by stimulation of the vagus causes an increase in the heart rate.

Some Experiments on the Lobster's Heart. REID HUNT. Read by title.

I. *Some General Properties of the Cardiac Muscle of the Lobster* (with Messrs. Bookman and Tierny). 1. The latent period caused by electrical stimulation is very short, varying according to the condition of the heart from $\frac{1}{25}$ to $\frac{1}{100}$ of a second. 2. The heart responds to stimulation during every phase of a contraction, whether this is spontaneous or has been caused by previous stimulation, *i. e.*, there is no refractory period (the latent period, however, was not investigated as to this point). 3. A true summation of contractions is easily produced; one contraction can be superimposed upon another until the resulting contraction is many times higher than any single (maximal) contraction. 4. Complete tetanus is readily produced, as has been observed by Howell for the crab's heart; the number of stimuli necessary to produce it varies greatly according to the condition of the heart, 4 to 6 per second being sufficient as a rule. 5. The height of the contraction varies (up to a maximum) with the strength of the stimulus, *i. e.*, the 'all or nothing' law does not hold.

II. *The Effect of Changes of Temperature upon the Lobster's Heart* (with Messrs. Lyman and Williams). Most of the results were obtained with hearts removed from the body and placed in the lobster's defibrinated blood; the temperature of the blood could be altered as desired. The force and frequency of the beat increased as the temperature was lowered from that of the room (18° C.) to about 13° C., which seemed to be, as a rule, the optimum temperature for hearts in the body as well as for the isolated ones. As the temperature was lowered still farther, the beats became more rapid but feebler; the temperature was not carried below 2° C., but the heart beat well at this temperature. When the temperature was raised above the optimum, the beats became fewer and irregular and the heart went into heat standstill at a remarkably low temperature; upon cooling it beat again, unless it had been exposed to a too high temperature. The temperature at which a standstill occurred varied according to the condition of the heart; previous cooling and long exposure caused it to occur at very low temperatures. The heart was never observed to beat above 22° C., although it responded to electrical stimulation up to 27°. The crab's heart goes into standstill at a much higher temperature (45–50° C.). Sudden changes of temperature caused a temporary acceleration. A moderate degree of tension on the heart caused a much more rapid beat.

The Innervation of the Heart of the Guinea Pig. D. W. HARRINGTON.

In the guinea pig the average blood pressure in the carotid artery is 78.25 mm. of mercury; the average rate of heart beat,

200 per minute; the average number of respirations at a temperature of 68° F., 72. Both vagus nerves are inhibitory and apparently equally so. They do not seem to be in a state of tonic activity. Stimulation of the central end of one vagus gives the usual slight fall of blood pressure, with slowing of the heart if the other nerve be intact. Stimulation of the peripheral end gives different results in different seasons of the year. In the fall and early winter months vagus excitation results in a gradual and moderate slowing but never stoppage of the heart, a gradual and moderate fall of blood pressure, and on cessation of stimulation a gradual return to the normal rate and blood pressure. In the late winter and spring months even with weak stimulation the heart is easily and suddenly stopped and held at a standstill; the fall of blood pressure is sudden and marked; the rise of pressure is generally sudden and often far above the normal, with a following gradual fall below the normal level. The tracings show considerable irregularity. A marked depression in the vitality of the animals was noticed at this time, which seems to be associated with the seasons and to be of practical importance, in view of the fact that guinea pigs are used so largely in experimental pathology. The heart 'escapes' quickly from vagus stimulation, but, on the whole, the latter seems to be deleterious to cardiac action, leaving the heart weaker and the blood pressure lower than normal. After escape from one vagus has commenced, stimulation of the other usually brings the heart to a standstill a second time. There is some evidence that in the guinea pig there is a separate depressor nerve, but further work is necessary to make it conclusive.

Ending of Sensory Nerves in the Viscera with special reference to such Endings in the Bladder. (*Demonstration.*) G. Carl Huber.

Gaskell, Langley and Edgeworth have described large medullated fibres in the sympathetic system. These large fibres no doubt come from the spinal and other sensory ganglia. Kölliker suggests that some of these fibres are destined to supply the Pacinian corpuscles. The author has found that the bladder of the frog is a most suitable object for studying the free ending of such sensory fibres. Large medullated fibres, which could often be traced through several small sympathetic ganglia, found in the wall of the bladder, could then be followed through their several branchings until their terminal branches found between the epithelial cells lining the bladder were reached. A single nerve fibre was found to innervate an area of about $\frac{1}{4}$ sq. mm. These endings resemble very closely the free sensory endings described for the mouth and skin.

The preparations were stained in methylene blue and fixed in a solution of ammonium picrate. They were then cleared in a mixture of glycerine and ammonium picrate, in which solution they were mounted.

Endings of Sensory and Motor Nerves in the 'Muscle Spindles' of Voluntary Muscle with demonstration of preparations. G. C. Huber (with Mrs. De Witt).

In 1860 Weismann described in embryonic striated muscle peculiar fibres with a large number of nuclei. Similar structures have been found widespread in vertebrate muscle and have been called 'muscle spindles.' Their nature has been variously regarded. They contain muscle fibres within a capsule and both motor and sensory nerves go to them.

The author has studied them in the frog, snake, cat, dog, rabbit, rat and guinea pig. The nerve fibres and endings were stained in methylene blue. They were then cleared in ammonium picrate and glycerine for teasing, or were cut into sections and double stained with alum carmine to bring out

the muscle fibres and capsule. In well-stained preparations the complexity of the nerve ending is too great for description here. It may, however, be stated that large medullated fibres (sensory), which supply these structures, divide often into several branches before reaching the spindle. Within the spindle they lose their medullary sheath and terminate in band-like structures which are wound around the muscle fibres of the spindles, usually making a few turns before ending on these fibres. Motor endings also occur on the spindle fibres, more often in the terminal portion of the spindle.

It may be suggested that, owing to the spiral arrangement of the terminations of the nerve fibres going to the spindle, the simple contraction of the muscle fibres of the spindle and their consequent enlargement might stimulate the nerve fibres.

The Protagon of the Brain. R. H. CHITTENDEN.

The author reported a series of results obtained by Mr. Frissell in a study of protagon. The total amount of phosphorus in sheep's brain by direct determination was found to be 1.664 per cent. calculated on the dry solid matter of the tissue. Of this amount 0.234 per cent. existed as protagon; 1.143 per cent. as lecithin or other like soluble bodies; and 0.213 per cent. in the form of nucleo-proteids, nuclein and inorganic salts. The results seemingly indicate that protagon contains but a small proportion of the total phosphorus of the brain and that other phosphorized organic bodies, such as the lecithins, are present, preformed in the tissue, in relatively large proportion. If we assume that all of the alcohol-soluble phosphorus of the brain, aside from the protagon, exists in the form of lecithins, we have 72 per cent. of the total phosphorus of the tissue present as lecithin, with only 15 per cent as protagon and 13–14 per cent. as nucleo-proteids and inorganic salts. Now protagon contains approximately 1 per cent. of phosphorus, while distearyl lecithin contains 4.13 per cent. of phosphorus; hence on the basis of the above figures the dry solid matter of the brain contains as much or even more lecithin than protagon.

A large number of samples of pure protagon prepared from the brains of oxen, sheep and calves showed an average content of phosphorus of 1.12 per cent, thus agreeing closely with Rappel's results. Careful study of these samples showed that, contrary to previous statements, protagon tends to undergo cleavage by long-continued heating at 45°C. in 85 per cent. alcohol, a certain amount of an alcohol-soluble (at 0° C.) body richer in phosphorus than protagon, being split off while the residual protagon obtained by recrystallization at 0° C. contained a somewhat diminished percentage of phosphorus. In other words, the stability of protagon is not quite as great in 85 per cent. alcohol as is generally stated. On the other hand, the lability of protagon is not sufficiently great to account for all of the lecithins or other soluble phosphorized principles found in fresh brain tissue. Obviously these results do not furnish any evidence as to whether the lecithin or other phosphorized bodies found in the fresh brain tissue originate directly or indirectly from the metabolism or cleavage of protagon during the life of the tissue.

An Ergometer. J. MCKEEN CATTELL.

The instrument exhibited was a dynamometer made to write on a kymograph. The maximum pressure of the thumb and forefinger or the movement of a single finger could thus be registered, and a series of movements showing fatigue could be recorded. The curves give the actual amount of work done, the height of the curves being proportional to the pressure in kilograms. The instrument was compared with Mosso's ergograph, and curves were shown in which the movements made in

lifting a weight and in extending a spring were simultaneously recorded. It was evident that the ergograph curves did not give a correct measure of fatigue, and of course gave no record when the weight was not lifted, whereas the ergometer curves measured more nearly the actual course of fatigue. The instrument is being used in the psychological laboratory of Columbia University to study fatigue and the effects of sensations and emotions on movements.

The Form of the Muscle Curve. F. S. Lee.

Under the author's direction the curve of contraction has been studied with improved apparatus in the muscles of the turtle, by Messrs. Furman and Turnure, and in the muscles of the frog, by Messrs. Beer and Gould. In the turtle the curves of different muscles differ greatly in form and time relations. The period of shortening is from two to five times that of the frog's gastrocnemius. A feature of interest is the enormous length of the period of lengthening which, *e. g.*, in the pectoralis major, may amount to fifteen seconds or three hundred times the period of the frog's gastrocnemius. With the present tendency to consider muscular relaxation an active rather than a passive phenomenon, this whole period of lengthening must be taken account of in determining the time relations of the muscular contraction. The turtle's muscles respond more readily to the make of an induction current than to the break, thus differing from those of the frog, and evidently possessing less irritability than the latter. This fact, as well as that of the very long curve of contraction, is in harmony with the sluggish movements of the animal.

In the frog the curves of different muscles thus far studied resemble one another in form and time relations much more closely. Some muscles seem to show a physiological resemblance to those of the turtle in having a prolonged period of relaxation.

The Nerve Impulse in its Relations to the Strength of the External Stimulus. C. W. Greene.

The electric current which occurs in an isolated living nerve when a nerve impulse passes along its course may now be considered as a qualitative and quantitative measure of nerve physiology. The auther has reinvestigated and extended Waller's results on this action current. Isolated nerves of frogs, turtles, cats and dogs, five to six centimeters long, were placed across stimulating and leading-off non-polarizable electrodes in a moist chamber. The faradic stimulating current was measured by an electro-dynamometer and the action current by a delicate Rowland galvanometer. (1) With equal increments of increase in stimulus above that necessary to produce a minimal deflection to a strength necessary to produce a maximal muscle effect there is a very rapid increase of action current and by equal increments. (2) With further increase in stimulus there is in the action current a continued strong increase, at first by equal but later by diminishing increments. If the results be plotted, the stimuli being placed along the abscissa and the successive action currents erected as ordinates, the curve here shows a concavity toward the abscissa. (3) With still stronger stimuli, to tenfold and more, there is only a slight further increase in action current and by equal proportional increments. This limb of the curve is important in its bearing on the nature of the nerve impulse.

Some Observations in a Case of Human Pancreatic Fistula. F. Pfaff.

The subject of the observation was a male patient in the City Hospital of Boston. Dr. H. W. Cushing had operated on the patient for an abdominal tumor. As a result of the operation a fistula formed, through which a clear watery fluid was secreted. This fluid had an alkaline reaction, digested proteids with formation of

peptone, transformed starch into sugar, and split neutral fat into fatty acid and glycerine, thus proving to be pancreatic fluid. The flow of this pancreatic secretion was observed during 48 consecutive hours. The quantities collected each hour were measured and the amount of solids and ash determined in each sample. The quantities secreted each hour were represented in a curve. This curve showed a striking resemblance to the curve representing the flow of bile, observed in a case of biliary fistula, which was reported by Dr. Pfaff at the last Christmas meeting of the Society. The total quantity of pancreatic fluid collected during 24 hours was much larger than is generally admitted for human beings. Some observations were also made on the composition of the urine and the feces during the time that the fistula was patent.

α-Methyl-quinoline as a Constituent of the Secretion of the Anal Glands of Mephitis Mephitica. T. B. ALDRICH (with WALTER JONES).

In a paper published recently by the author it was stated that the secretion of the skunk, *Mephitis mephitica*, can be sharply separated by distillation into two approximately equal portions, and the more volatile portion was shown to be a mixture of mercaptans. From the portion of higher boiling point the authors have since succeeded in isolating a compound which can easily be identified as α-methyl-quinoline. The method of isolation is as follows: The higher boiling fraction of the original secretion is shaken several times with a 50 per cent. solution of caustic potash and then washed with water until all the alkali is removed. The product thus freed from all traces of mercaptans is extracted with several portions of very dilute hydrochloric acid, and the united acid extracts are evaporated to dryness on a water bath. The residue is taken up in a little water that has been acidified with hydrochloric acid, and is treated with a solution of zinc chloride, when a finely crystalline precipitate of the zinc chloride addition product with the base is formed, which can be purified by crystallization from water. This compound is decomposed with an excess of sodium hydroxide, and the base thus liberated is distilled with steam. The distillate is extracted with ether and the ether is allowed to evaporate. There remains a practically colorless, highly refracting oil whose physical properties accord with those of α-methyl-quinoline. Two portions of the oil were dissolved in hydrochloric acid and treated, one with platinum chloride and the other with gold chloride. In each instance a beautifully crystalline precipitate was obtained, which on complete analysis gave results which show the base to be correctly represented by the formula $C_{10}H_9N$. The composition of the double compounds are in accordance with the formulas $(C_{10}H_9N.HCl)_2\,PtCl_4$ and $C_{10}H_9N.HCl.AuCl_3$.

A compound having the properties and composition of this base could only be one of the methyl-quinolines and, as only one of these isomeric substances forms an anhydrous double compound with platinum chloride, the identity of the natural base seems to be determined. This conclusion was confirmed by comparison of the base with artificially prepared α-methyl-quinoline.

Upon the afternoon of Wednesday, May 5th, in the National Theatre, the Society joined with the Association of American Physicians and the American Pediatric Society in a public discussion before the Medical Congress. The subject of the discussion was 'Internal secretions considered in their physiological, pathological and chemical aspects.' The Society was represented by two speakers: a paper by Professor W. H. Howell upon 'The General Physiology of Internal Secretions' was read by the Secretary in the absence of Professor

Howell because of illness; and Professor R. H. Chittenden read a paper upon 'Internal Secretions: Considered from a Chemico-physiological Standpoint.'

These addresses will appear in an early number of SCIENCE.

FREDERIC S. LEE,
Secretary.

COLUMBIA UNIVERSITY.

THE INTRODUCTION OF NEW TERMS IN GEOLOGY.

THE third circular sent out this year by the Committee of the International Congress of Geologists makes this statement: "*L' inondation de nouveaux termes dans le science a atteint de telles dimensions, que bientôt aucune mémoire d'homme ne sera en état de retenir toute la masse des dénominations nouvelles et que la lecture de chaque mémoire nécessitera l'emploi d'un glossaire special.*" In another paragraph new terms are spoken of as 'evidently nothing more than a useless incumbrance to the science.'

Writers on scientific subjects have often heard complaints about their 'hard words,' but these complaints have generally come from laymen; we have not before had an uprising in our own ranks. In our opinion it has come none too soon. One can scarcely read a paper on geology nowadays without feeling thankful for what is not in it, if he reaches the end without running upon some new term or some new use of an old one. Indeed, we lately saw a review of a text-book which the writer ended with the remark that not the least of the book's many virtues was the fact that the author had avoided the introduction of new terms.

We Americans have contributed our big share to this 'inundation,' and have aggravated the case by the use of Indian words and place-names that are not familiar even in this country except locally. In order to get an idea as to how far some of these words are comprehended by the common run of educated people in this country, we have inquired of many persons what idea the word 'Monadnock' conveyed to their minds. Most of them had seen the word, but knew nothing of its original meaning. One young man said he didn't know what it meant, but it was the name of a big office building in Chicago. Another one knew it only as a warship in the American Navy.

Such names are said to be used on account of their fastening in the mind certain series of facts. But where is this thing to end? We now have a bare hill protruding from the ice called a 'Nunatak,' and if one of our term-makers should visit Iceland we should soon have 'Jökul,' the name for a snow-capped peak.

A hill with one history is a 'Monadnock,' with another it is a 'Cotoctin,' and with another it is a 'Katahdin.' For as good reason we might call a synclinal valley a 'Lackawanna,' a synclinal mountain a 'Shickshinny,' a monoclinal ridge a 'Pindamonhangába,' and an anticlinal ridge a 'Jacarepaguá.' And when the bewildered European geologist doesn't know what they all mean we act the part of one of Bret Harte's characters who inquired of the man who hadn't heard of his partner:

> What? "Didn't know Flynn,
> Flynn of Virginia?
> Look 'ee here, stranger,
> Whar *hev* you been?"

New terms are often defended on the ground of their being logical. A little thought will convince any one that geology —not an exact science—can never have a logical and precise system of terms. Besides, the logic of the names of rocks, minerals and releaf features has nothing to do with the science of geology as a science, while the fixity of a nomenclature is of much more importance than any logic or special fitness of the words themselves.

Names are mere conveniences—museum

tags—that may be changed or taken away entirely without destroying the value or changing the nature of the thing. It is the thing itself that is important, not its name.

Sometimes the desire for innovations, when it can find no other changes to make, gives an old term a new meaning or substitutes a high-sounding word for a simple one. Occasionally these terms are poured fourth in such quantities that it looks as though their author had certainly invented a new science. Surely nothing can be more out of place than this cluttering up of scientific literature with verbiage that calls attention away from the subject under discussion.

Those who have done most for the spread of the knowledge of science have used the simplest language and, just so far as possible, have avoided technicalities. They have gone on the principle that what one has to say should be so said as to be understood by as many readers as possible, especially if the simplicity of the language makes clear rather than obscures the meaning.

It is earnestly to be hoped that the more sober-minded of our geologists, educational institutions and scientific societies will discourage the use of new terms when they are not absolutely necessary.

Since the above was written we have seen Dr. C. Hart Merriam's timely article in SCIENCE (May 7, 1897, p. 731) upon a 'useless and formidable,' 'disheartening and ever increasing mass of terminology.' We beg to commend it to geologists.

JOHN C. BRANNER.

STANFORD UNIVERSITY, CALIF., May 15, 1897.

CURRENT NOTES ON ANTHROPOLOGY.

SYSTEMATIC ANTHROPOLOGY.

SCHEMES, systems, plans, are of value in sciences as both indicating the directions in which investigations should be pursued and the convenient arrangements of ascertained facts. Like definitions of scientific terms, they are only provisional, suited to the present sum of knowledge, but are none the less useful for that.

In the last number of the 'Centralblatt für Anthropologie' (Heft. 2, 1897) the well-known writer, Dr. Emil Schmidt, of Leipzig, proposes the following comprehensive scheme:

Anthropology, the Study of the Human Species.

I. Natural Historical Treatment.
  A. Physical Anthropology.
    a. Man as a zoological species.
    b. The Races of Men.
      1. Descriptive treatment, Phylography.
      2. Investigation of physical principles, Phylology.
  B. Ethnic Anthropology.
    a. Descriptions of Peoples, Ethnography.
    b. Investigation of psychical principles, Ethnology.

II. Historical Anthropology or Prehistory; investigation of the earlier and lower stages of humanity.

The neologisms, phylology and phylography he introduces from *Φὐλη*, which he explains as the physical, while *ἔθνος* is the social and psychical group. His objections to previous schemes are also stated.

ABORIGINAL CULTIVATION OF MAIZE.

AGRICULTURE in primitive America is the more important as a cultural stage owing to the total absence of the pastoral life. Maize was usually the principal cultivated plant, and for that reason a study by Mr. Gardner P. Stickney on its use by the Wisconsin Indians (Parkman Club Publications, No. 13) merits especial attention. It is the result of close reading of the old authors and of local investigation. His conclusions are that the Wisconsin Indians raised it in large quantities, enough for their own wants, and an excess, which they used in trade; while even those tribes in the area of the State who dwelt so far north that it was an uncertain crop gave considerable attention to it, and sometimes raised it in abundant fields. These tribes belonged

to the widespread Dakotan and Algonquian stocks, and thus we find the aborigines carrying the culture of this noted tropical plant up to the northernmost limits of its possible propagation.

THE GROOVED STONE AXE.

THE statement is occasionally made in lectures and articles on the American aboriginal stone industry that the grooved and polished axe, so common in our collections, is an artefact peculiar to our continent.

It is true that in its special shape it is rare in European collections. They have the grooved maul or pounder, but not often the polished axe with the groove running round near the butt and with a sharpened edge. A fine example, however, from southern Italy, is described and figured by Dr. Schoetensack in the 'Zeitschrift für Ethnologie' (Heft I., p. 9, 1897). That it was of local origin was proved by the kind of stone of which it was made. He refers to its similarity to American specimens, and quotes other instances where they have been found in the Old World. This is but another example where the artificial products of early man reveal striking similarities in all continents.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

IN the last proceedings of the Chemical Society (London), A. E. Munby describes a Bunsen burner for acetylene which has proved very satisfactory in his hands. The tube is only five millimeters in diameter, or a slightly wider tube may be used, provided the mouth be curved inwards. With a larger opening there is a tendency for the flame to strike down. The gas jet is very small, delivering only one foot of acetylene per hour, under six inches of water pressure. The air holes must be large, and with sufficient air a non-luminous flame is given. The heating effect of the acetylene gas is large, and seems to be about twice that of coal gas. Mr. Munby suggests that the use of such a convenient source of heat should do much to stimulate research in country places, where, coal gas not being procurable, heretofore no good source of heat was available.

IN the same number Heycock and Neville, who have done so much to further our knowledge of alloys, describe the study of the sodium-gold alloys with the X-rays. Sodium is much more transparent to the rays than gold, and X-ray photographs of thin sections of the alloy show its crystalline structure very clearly. The authors point out that other alloys may be similarly studied, and are at present engaged of those of aluminum. It is possible that by this method our knowledge of alloys may be materially extended.

IN a graduating thesis at Washington and Lee University, Mr. J. R. K. Cowan takes up the question of the presence of tin in canned goods, and his results confirm those of previous investigators along this line. He finds tin present in every can examined, including tomatoes, peaches, apricots and sweet potatoes, in quantities of from 60 to 150 miligrams per kilo. Granting that this tin is present in a form which can be acted upon in the human system, and considering the large consumption of canned goods, it seems to follow that tin is less toxic than has been supposed and that it cannot be a cumulative poison. The maximum dose of tin is given as half a grain of chlorid, but the amount of tin corresponding to this might often be taken into the system during a single meal. Very few cases of supposed tin poisoning from eating canned goods have been reported, and it is probable there is little danger from this source. In no instance did Mr. Cowan detect the presence of lead.

IN the last *Chemical News* Delafontaine gives an account of further researches on the more deeply colored of the rare earths. This recent work was with Fergusonite from Bluffton, Texas, and he confirms the existence of the element philippium, discovered by him nearly twenty years ago, but whose independent existence as an element has been questioned by Roscoe and other observers. It is more closely related to terbium and cesium than to other rare earths, but is distinguished from both by marked reactions and the deep color of its oxid and subnitrate.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE officers of sections at the Toronto meeting have now been selected, although others may subsequently be added to the list. All the officers expect to attend the meeting and American men of science who are able to be present will thus have the privilege of meeting many of the leaders in science of Great Britain. The officers are as follows:

A.—MATHEMATICAL AND PHYSICAL SCIENCE.

President, Prof. A. R. Forsyth, M.A., D.Sc., F.R.S.
Vice-Presidents, R. T. Glazebrook, M.A., F.R.S.; Prof. A. Johnson. M.A., LLD.; Prof. O. J. Lodge, D.Sc., F.R.S.
Secretaries, J. C. Glashan; Prof. W. H. Heaton, M.A. (*Recorder*); J. L. Howard, D.Sc.; Prof. J. G. McGregor, D.Sc., F.R.S.E.

B.—CHEMISTRY.

President, Prof. W. Ramsay, Ph.D., F.R.S.
Vice-Presidents, Prof. H. B. Dixon, M.A., F.R.S.; W. R. Dunstan, M.A., F.R.S.; Prof. B. J. Harrington, Ph.D., F.G.S.; Prof. W. H. Pike, M.A., Ph.D.; Prof. W. C. Roberts-Austen, C.B., F.R.S.; T. E. Thorpe, Ph.D., F.R.S.
Secretaries. Prof. W. H. Ellis, M.A., M.B.; Arthur Harden, Ph.D., M.Sc. (*Recorder*); C. H. Kohn, Ph.D.; Prof. R. F. Ruttan.

C.—GEOLOGY.

President, Dr. G. M. Dawson, C.M.G., F.R.S., F.G.S.
Vice-Presidents, Prof. C. Le Neve Foster, D.Sc., F.G.S., F.R.S.; Dr. H. Woodward, F.R.S., F.G.S.
Secretaries, Prof. A. P. Coleman, Ph.D.; G. W. Lamplugh, F.G.S.; Prof. H. A. Miers, F.R.S., F.G.S. (*Recorder*).

D.—ZOOLOGY.

President, Prof. L. C. Miall, F.R.S., F.L.S.
Vice-Presidents, Prof. W. A. Herdman, F.R.S.; Prof. R. Meldola, F.R.S.; Prof. E. B. Poulton, F.R.S.; Prof. R. Ramsay Wright, M.A., B.Sc.
Secretaries, W. Garstang, M.A., F.Z.S., (*Recorder*); W. E. Hoyle, M.A.; Prof. E. E. Prince, B.A.

E.—GEOGRAPHY.

President, J. Scott Keltie, LL.D., Sec. R.G.S.
Vice-Presidents, President N. Burwash, LL.D.; Major L. Darwin, Hon. Sec. R.G.S.; E. G. Ravenstein, F.R.G.S.
Secretaries, Col. F. Bailey, Sec. R.S.G.S.; Capt. E. Deville, H. R. Mill, D.Sc., F.R.G.S. (*Recorder*); J. B. Tyrrell, M.A.

F.—ECONOMIC SCIENCE AND STATISTICS.

President, Prof. E. C. K. Gonner, M.A., F.S.S.
Vice-Presidents, Prof. W. Clark, M.A., LL. D.; Sir C. W. Fremantle, K.C.B.; Prof. J. Mavor.
Secretaries, E. Cannan, M.A., F.S.S.; H. Higgs, LL.B., F.S.S. (*Recorder*); Prof. Adam Shortt, M.A.

G.—MECHANICAL SCIENCE.

President.—G. F. Deacon, M. Inst.C.E.
Vice-Presidents, Prof. W. E. Ayrton, F.R.S.; Prof. H. T. Bovey, M.A.; Sir C. Douglas Fox, M. Inst. C.E.; Prof. John Galbraith, M.A.
Secretaries, Prof. T. Hudson Beare, F.R.S.E. (*Recorder*); Prof. Callendar; Prof. Dupuis; W. A. Price.

H.—ANTHROPOLOGY.

President, Prof. Sir W. Turner, M.B., LL.D., F.R.S.
Vice-Presidents, E. W. Brabrook, Pres. Anth. Inst.; G. L. Gomme, F.S.A.; R. Munro, M.D., F.R.S.E.
Secretaries, A. C. Chamberlain, Ph.D.; H. O. Forbes, LL.D.; J. L. Myres, M. A., F.S.A. (*Recorder*).

I.—PHYSIOLOGY.

President, Prof. Michael Foster, M.A., LL.D., Sec. R.S.
Vice-Presidents, W. H. Gaskell, M.D., F.R.S.; Prof. A. B. Macallum, M.B., Ph.D.; Prof. A. D. Waller, M.D., F.R.S.
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K.—BOTANY.

President, Prof. H. Marshall Ward, D.Sc., F.R.S., F.L.S.

Vice-Presidents, Prof. F. O. Bower, D.Sc., F.R.S., Prof. D. P. Penhallow.

Secretaries, Prof. J. B. Farmer, M.A., F.L.S.; E. C. Jeffrey, M.A.; A. C. Seward, M.A., F.G.S.; Prof. F. F. E. Weiss, B.Sc., F.L.S. (*Recorder*).

THE BRITISH REPORT ON THE BEHRING SEA SEAL FISHERIES.

A Parliamentary paper was issued on May 22d containing Professor D'Arcy Thompson's report on his mission to Behring Sea. The report concludes as follows:

In the foregoing account I have merely set forth my observations of the herd and its past history in so far as both together show that the alarming statements to which utterance has been given in recent years, the accounts of the herd's immense decrease and the prophecies of its approaching extinction, are overdrawn and untenable. But it is my duty to state to your lordship that there is still abundant need for care and for prudent measures of conservation in the interests of all. A birth-rate which we estimate at 143,000 per annum is not great in comparison with the drain upon the stock. From one cause or another a loss of over 20,000 is experienced among the pups ere they emigrate to sea; and though the dangers they there encounter are unknown to us, we may take it for certain that the risks they run are great and the loss they endure considerable. When to the measured loss in infancy and to the unmeasured loss in youth and age we add the toll taken on the islands and the toll taken in the sea, it is not difficult to believe that the margin of safety is a narrow one, if it be not already in some measure overstepped. We may hope for a perpetuation of the present numbers; we cannot count upon an increase. And it is my earnest hope that a recognition of mutual interests and a regard for the common advantage may suggest measures of prudence which shall keep the pursuit and slaughter of the animal within due and definite bounds.

The London *Times*, which is supposed to reflect official opinion, publishes a column and a-half of editorial comment, ending as follows:

Our own commissioner is entirely of the same opinion [referring to Dr. Jordan's recommendation of further scientific investigation], and is much more cautious in the conclusions to which he has come. In these circumstances it seems only common sense to collect further evidence before we proceed to revise the present regulations. We are ready to admit that they may not be the best which it is possible to devise in the interests both of pelagic and of shore sealers. But we say that this has not yet been proved, and that until it is proved we are under no obligation to vary the present rules. The suggestion that we should surrender the exercise of a lucrative industry which is admittedly lawful, without receiving an equivalent, merely in order to increase the actual and prospective profits of our rivals, is not admissible in any event. What would the United States answer to a similar proposal in regard to the fishery rights they possess on the 'American Shore' in New Foundland? They would answer, 'It is not business.'

GENERAL.

Professor W. Crookes will be nominated as President of the British Association for the Bristol meeting of 1898.

Professor Felix Klein has been elected a corresponding member of the Paris Academy of Sciences in the room of the late Professor Sylvester.

Mr. Robert Douglas, known for his work in arboriculture and forestry, died on June 1st at Waukegan, Ill. He was born in England in 1813. Mr. Charles Benjamin Brush, formerly professor of civil engineering in New York University and a well known civil engineer, died in New York on June 3d, aged forty-nine years. The death is also announced of Sir Augustus Wollaston Franks, F.R.S., the archæologist, at the age of seventy-one years; of Dr. G. Ossowski, the geologist, at Tomsk, on April 16th; of Dr. Edwin Freiherr v. Sommaruga, assistant professor of chemistry at the University of Vienna, on May 10th, at the age of fifty-three years; and of A. L. O. Descloizemitt, the mineralogist member of the Paris Academy, on May 8th, at the age of seventy-nine years.

The Rede lecturer of Cambridge University, Professor A. W. Rücker, was announced to deliver his lecture on June 9th, the subject being 'Recent Researches in Terrestrial Magnetism.'

We learn from *Nature* that at the anniversary meeting of the Linnæan Society of London, held on May 24th, the gold medal of the Society was awarded to Dr. Jacob Georg Agardh, emeritus professor of botany in the University of Lund, known for his researches on *Algæ*.

An expedition from the biological department of the University of New York, under the direction of Professor Charles L. Bristol, sailed from New York for Bermuda, on June 3d. General Russell Hastings has offered the University land

near Hamilton, Bermuda, for the erection of a permanent biological station. Professor Bristol is accompanied by Dr. Tarleton H. Bean, director of the New York Aquarium, who will make collections for the Aquarium; by Walter Rankin, of Princeton University; by Mr W. H. Everett, instructor, and by several students of New York University.

DR. J. E. HUMPHREY, lecturer in botany in Johns Hopkins University, has left Baltimore for Jamaica with a party of students which will probably be joined later by Professor W. K. Brooks. A house for a marine biological laboratory has been secured at Port Antonio, on the north side of the Island. In other years the laboratory has been located at Port Henderson, on the south side, but it is thought that a change may offer new materials and opportunities.

NEWS from Adelaide indicates that Charles F. Wells and J. W. Jones were killed by natives while exploring central Australia. The expedition of five persons, led by Mr. A. L. Wells, was fitted out by Mr. Alfred L. Calvert and crossed the inland desert of Australia, starting from Cue, West Australia, in June of last year.

AN expedition fitted out by the Canadian government left Halifax on June 2d to investigate the practicability of the Hudson Bay route to Europe, especially for the shipment of grain from the Northwest.

THE New York *Evening Post* has printed an account of the discoveries of Dr. Sven Hedin, a Norwegian, who for the past three years has been exploring the least known regions of Persia, Russian Turkestan and the Pamirs. Among other interesting discoveries he is said to have found ruins of a city buried in the sands, containing valuable manuscripts.

IT is reported that Captain Sverdrup will go with the Fram to Smith's Sound next year, spend the winter there, and then attempt a sledge journey northward.

LIEUTENANT PEARY will be accompanied this summer by a party under the direction of Mr. Russell W. Porter, who will make explorations in Baffin Land. A party from Colby University will also go north with Lieutenant Peary.

THE New York Aquarium was visited by no less than 21,456 persons on Sunday, June 6th.

IT is proposed to enlarge the Missouri Botanical Garden, so that the land belonging to the Shaw estate, over eighty acres in extent, will be gradually added to it. It is planned to drain and grade twenty-one acres during the present season.

THE will of Mrs. Sarah Withers, of Bloomington, Ind., bequeaths $40,000 to found a library in Nicholasville, Ky., where she was born. Some years ago she established the Withers library in Bloomington.

MR. F. J. WALZ has been sent by the United States Weather Bureau to take charge of the Maryland State Weather Service, which is conducted at the Johns Hopkins University, by the cooperation of the government, the University, the State and the Maryland Agricultural College.

THE last meeting for the present season of the American Mathematical Society was held at Columbia University on May 29th. Papers were presented by Professor F. Morley, of Haverford College; Dr. Emory McClintock, of New York, and Dr. E. O. Lovett, of Johns Hopkins University. The regular meeting of the Society will be held hereafter in New York on the last Saturday in October, December, February and April, each meeting to consist of a morning and afternoon session, which will allow as much time as the present monthly meetings. The Chicago Section will hold meetings in December and April of each year. The Society holds its summer meeting at Toronto on August 16th and 17th.

THE American Medical Association held its semi-centennial celebration at Philadelphia on June 2d, 3d and 4th. The address by the President, Dr. Nicholas Senn, reviewed the work of the Association, its past, its present and its future. Dr. Austin Flint, of New York, gave the address in medicine, and Dr. W. W. Keene, of Philadelphia, the address in surgery. The Association was also addressed by the President of the United States, the Governor of Pennsylvania and the Mayor of Philadelphia. It was reported that only about $4,000 had been subscribed to the monument to

Benjamin Rush, to be erected at Washington, but the amount was much increased by subscriptions at the meeting. The Association will next meet at Denver, under the Presidency of Surgeon-General George M. Sternberg.

A CONFERENCE of the members of the Institution of Civil Engineers was held in London this year under conditions convenient to many who are precluded from attending the weekly meetings during the session, and serviceable to all by the discussion of a wider range of subjects than can be dealt with on ordinary occasions. The business of the conference differed from the ordinary proceedings of the institution, papers descriptive of works executed giving place to brief statements concerning important debatable matters in engineering science and practice, introduced with a view to eliciting discussion on the questions raised. The conference was held on May 25, 26 and 27, the morning of each day (from 10:30 to 1:30) being devoted to the consideration of the statements referred to, and visits of inspection to engineering works being made in the afternoon. The work of the conference was carried out under the direction of the Council, with the assistance of seven sectional committees. The sections were: Railways, with Sir Benjamin Baker as chairman; harbors, docks and canals, Mr. Harrison Hayter, chairman; machinery and transmission of power, Sir Frederick Bramwell, chairman; mining and metallurgy, Mr. T. Forster Brown, chairman; shipbuilding, Sir William H. White, chairman; waterworks, sewerage and gasworks, Mr. Mansergh, chairman, and applications of electricity, Mr. W. H. Preece, chairman.

A *Revue Philanthropique* will hereafter be published in Paris by Masson et Cie, edited by M. Paul Strauss. The *Revue* will be published monthly, each number containing 160 large pages. The first number contains articles of considerable scientific interest.

THERE has been established in Italy a 'Società Positivista,' whose object it is to demonstrate the importance of science for modern life. The society has established a bi-monthly journal entitled *Il Pensiero Moderno*, published by the Society at Via Collegio Romano, 26, and edited by Professor G. Sergi. Professor Sergi contributes an introduction and an article to the first number. Professor Sergi is also one of the editors of a new *Revista Italiana di Sociologia*, which takes the place of the *Revista di Sociologia*, formerly edited by Professors Sergi and Tangorra.

THE first number of a monthly *American X-ray Journal* has been issued from St. Louis, being edited and published by Dr. Heber Roberts. It contains a portrait of Dr. Röntgen and a number of photographs especially intended for the medical profession.

THE report of the Medical Superintendent to the London Metropolitan Asylums Board on the use of anti-toxin and the treatment of diptheria during the year 1896 confirms the favorable results reached the previous year. The percentage of mortality being reduced from 29.6 in 1894 to 20.8 in 1896.

IT has been announced in the Legislative Assembly of Cape Colony that the shooting of cattle had been stopped as being a useless attempt to maintain a clean belt. It was added that it was impossible to prevent the rinderpest from reaching Cape Colony.

THE International Fisheries Exhibition at Bergen, to which we have already referred, will be opened on May 16, 1898. It will include the following groups: 1. Fish products. 2. Fishing apparatus. 3. Vessels employed in the catch and their equipment. 4. Preservatives. 5. Lodging ships, lodging houses and station huts. 6. Tank and other transport vessels. 7. Models and drawings of warehouses, salting establishments, smoke houses, ice houses and other cold rooms. 8. Machines, tools and apparatus. 9. Fish culture. 10. Pleasure fisheries. 11. Facts about the fisheries and their development. 12. The life-saving service.

UNIVERSITY AND EDUCATIONAL NEWS.

MCGILL UNIVERSITY, Montreal, receives $100,000 by the will of the late J. H. R. Molson, who was senior governor of the University.

THE REV. FATHER MACKAY has given $5,000 to the Catholic University of America for the foundation of a scholarship.

THE general board of studies of Cambridge University recommend that a University lectureship in physiological and experimental psychology, connected with the special board for biology and geology, be established for the term of five years from October next, and that the stipend of the lecturer be £50 a year.

PROFESSOR H. K. WOLFE has resigned the chair of psychology in the University of Nebraska. Dr. W. B. Pillsbury, now instructor in psychology in Cornell University, has accepted a similar position in the University of Michigan. Mr. F. C. S. Schiller, instructor in logic in Cornell University, will return to Oxford, having been elected fellow and tutor in Corpus Christi College. It is understood that Dr. C. E. Seashore, now assistant in Yale University, will be appointed assistant in psychology in the University of Iowa, and Dr. J. H. Leuba, lately fellow at Clark University, to a position in psychology in Clark University. Mr. S. I. Franz has been elected assistant in psychology in Columbia University.

PROFESSOR WILLIAM S. FRANKLIN, of Iowa University, has been elected to the chair of physics and electrical engineering at Lehigh University, filling the place vacant by the resignation of Professor Harding. Dr. John Marshall has been appointed to the chair of chemistry in the medical department of the University of Pennsylvania, vacant through the death of Professor Theodore G. Wormley.

MISS MARY E. PENNINGTON was appointed Thomas A. Scott fellow in hygiene in the University of Pennsylvania. Miss Bertha Stoneman, now at Cornell University, has been appointed to the chair of botany in the Huguenot College for Women in Cape Colony.

REV. R. E. JONES, of All Angels' Church, New York city, has been nominated for the Presidency of Hobart College, Geneva, N. Y.

PROFESSOR J. L. PREVOST has been elected professor of physiology in the University of Geneva. Dr. P. Francotte has been appointed professor of embryology and Dr. P. Stroobant professor of astronomy in the University of Brussels. Dr. J. J. Zumstein has been promoted to a professorship of anatomy in the University of Marburg.

DISCUSSION AND CORRESPONDENCE.

THE POTTER'S WHEEL IN ANCIENT AMERICA.

THE paragraph referring to American Ceramics, by Dr. D. G. Brinton, in SCIENCE, for May 21, 1897, page 797, containing the categorical statement that 'the device of the potter's wheel was (anciently) unknown in either North or South America,' should be noted as inadequate. Under the present knowledge of the subject, while referring, as a noteworthy substitute for the wheel, to a clay dish twisted by the Chillian Indians (Araucanians), so as to mould the clay ball resting in it (described in *Globus*, February 20, 1897), it would have been well to mention a similar device from the Southwest or Mexico, which, according to Professor Putnam, had been in the possession of the Peabody Museum at Cambridge, Mass., for sometime previously.

More uninstructive is it to ignore the *Kabal*, of Yucatan, a disc of wood caused to turn on a slippery board by the bare feet of the (present) Maya potter, while the clay sticking to the disc and revolving with it is thus made to mould itself symmetrically against the stationary fingers of the worker. This very noteworthy device, a primitive potter's wheel in the full sense, was observed and fully explained by the Corwith Expedition of the University of Pennsylvania to Yucatan in 1895. I illustrated it in 'Hill Caves of Yucatan' (Lippincott, Philadelphia, 1896, page 163), having previously described it to archæologists, in the *American Naturalist*, for May, 1895. A correspondence with Dr. Brinton upon the significance of the Maya word *Kabal* resulted in his failure to find the word in the Spanish dictionary of the Maya language, published at the monastery of Motul in 1576, upon which he argued, inconsequently I thought, that the device had been brought to Yucatan by Spaniards. On the other hand, the late Bishop of Yucatan and, I think, Captain Theobert Maler believed it to be indigenous, and I have as yet learned of no discovery of the *Kabal* device in Spain or among the Moors in Africa. Under these circumstances, whether final investigation shall prove the *Kabal* to have been of European or American origin, the general references above noted to the potter's craft in

the New World, omitting mention of this long unnoticed instrument (not yet described in duplicate, to my knowledge, anywhere else in the world), are unsatisfactory. The specimens attesting the interesting process, in the possession of the museum of the University of Pennsylvania, since 1895, cannot be ignored.

H. C. Mercer.

Indian House, May 23, 1897.

THE SIGNIFICANCE OF INTERNAL SECRETION.

The communication on the above subject published in Science for April 30th, by Mr. Albert Mathews, seems to me not only of interest, but of importance, because it indicates in a comprehensive way some of the directions in which our thoughts may move just now to advantage. Views not wholly unlike these of Mr. Mathews are hinted at in my 'Animal Physiology' (1889); but it has been especially in lectures to my most advanced class in physiology that, for ten years, I have been accustomed to insist on the bearing of the function of one part on that of another—a subject generally neglected in the books—and also the relation of the development of one tissue or organ as determined by another. Necessarily it was impossible, till more recent discoveries had been made, to indicate many of the ways in which this is brought about, and even yet we can do so but vaguely.

It was very natural, therefore, for me to hasten to read Mr. Mathews' communication to my class and to enforce its teaching by comparison with similar expressions of opinion in a paper entitled 'Experimental Cachexia Strumipriva,' published in the *Canadian Practitioner* in October (?) 1895. I venture to think that Mr. Mathews will find in this paper views as broad as his own, if not more so. To quote a single sentence: "No cell is so small, so distant from others, but that in some way it makes itself felt, and this is to me the most important lesson of all this recent development in physiology and medicine growing out of the study of the total or partial extirpation of organs, of transplantation, of feeding of glands, etc." The extension of the principle of the influence of the internal secretion to plants is admirable, in my opinion, and in this I am inclined to believe that Mr. Mathews is entirely original. However, while Mr. Mathews' views are broad they are apt, if taken alone, to lead to narrowness by their very exclusiveness. When he seeks to explain the co-ordinated life of plants in this way does he also remember the *protoplasmic continuum*, and when he would explain by internal secretion the co-ordination in movement, say, of one cell with another in simple invertebrates does he bear in mind the possibility of explanation through *molecular impact?* Life implies ceaseless molecular movement. Just now we are witnessing, in the medical world, the most remarkable development of chemical conceptions to explain pathological conditions that has yet taken place, but, as usual, with a narrowness that is evidence of the evil effects as well as the advantages of specialization. The doctrine of 'pangens' has always seemed to me a crude and unnecessary hypothesis, and I cannot believe that internal secretion *alone* will supply an adequate substitute, though it will assist to a better understanding of certain results in detail.

Nearly ten years ago I put forward a view in a paper entitled 'A Physiological Basis for an Improved Cardiac Pathology' (*Medical Record*, October 22, 1887), which, so far as I know, was then set forth for the first time in print, though it had been earlier taught in my lectures. This conception was more fully elaborated in 'The Influence of the Nervous System on Cell Life.' (*New York Medical Journal*, December 22, 1888.)

I endeavored to show that we were justified in holding that the nervous system exercised a *constant influence* over all cells, tissues and organs, either directly or indirectly, in every animal provided with such a system, this influence being the more important the higher the animal in the scale of existence. This theory of the constant influence of the nervous system over metabolism, etc., has, so far as I am aware, not been recognized or, at all events, taught by anyone except myself, till it was prominently brought forward last October by Professor M. Foster, the well-known physiologist, in his admirable Huxley lecture. It has since been publicly espoused by the distinguished neurologist Gowers, and will, I have no doubt, shortly receive the recognition which I have long felt it deserved.

To me this is a far more important single concept than any other to explain co-ordination of all kinds, even the continuance of the healthy life of cells in higher animals, unless it be that of the influence of protoplasm on protoplasm, *per se*, and directly. Nevertheless, this doctrine of the influence of one cell on another, through chemical agency, which the theory of the constant effect of the nervous system renders clearer for all higher animals, is one that is also indispensable and which we are now beginning to understand in more detail. The main purpose of this communication is to put forward as broad a basis as possible for conceptions of the nature of living things, for the exact demonstration of which in a way to satisfy a rigid logic we must still wait, it may be long, but which we cannot afford, in the meantime, to ignore without making many errors and unduly restricting the field of view.

WESLEY MILLS.

MCGILL UNIVERSITY,
MONTREAL, May 13, 1897.

HIGHHOLE COURTSHIP.

SOME mornings since I observed two highholes on the same branch evidently in courtship. The male, as I took it, would give a few clucks, and rapidly bob its head up and down four or five times describing about a quarter of a circle, and the female then responded with the few clucks and corresponding motions. This was repeated at short intervals, and they flew to another tree, and continued this rather comical performance. Mr. Burroughs, in describing this courtship of the highhole, speaks of the female as 'unmoved,' which, however, was plainly not so in this case. As the meaning of the head bobbing I would suggest that the motion, being much the same as when pecking at a tree or in the turf, may signify the offering of food. The male says, "Come with me and I will find you lots of fat grubs," and the female assents by the same acts and signifies mutuality. The whole is in the same line of sentiment and action as that of the young man who offers his best girl ice cream and soda water. I may also mention that I have often noticed this spring what I supposed to be the male blue jay approach his mate with a cluck and transfer to her bill some article of food, the whole affair appearing to be gallantry. It may even be that the kiss is a survival of lip-to-lip feeding.

As to the pugnacity of birds in early spring I may mention that some seasons since I observed a cock robin fight for some hours his own reflection in a cellar window. This season a mirror was placed upon a wren's box which had been usurped by a pair of English sparrows. The female fought her reflection most furiously, but the male showed more intelligence, investigated carefully, and would retire around the tree and peer out to see if the supposed bird would move toward the nest. At nightfall he took his place before the mirror, as if on guard. A carefully conducted series of experiments with mirrors upon birds and other animals would, by providing the new environment, be of great value in testing intelligence.

HIRAM M. STANLEY.

LAKE FOREST, ILL., May 5, 1897.

A QUESTION OF CLASSIFICATION.

TO THE EDITOR OF SCIENCE: In your issue of December 18, 1896, pp. 918–922, in a communication by myself entitled 'A Question of Classification,' through a typographical error I am made to say that "all other students place the Dakota formation in the middle of our American Upper Cretaceous." The word 'Upper' should have been omitted from this sentence, as it was my intention to say that "all other students place the Dakota formation in the middle of our American Cretaceous and at the base only of the upper of the two great series into which the Cretaceous of this country is divided."

ROBT. T. HILL.

SCIENTIFIC LITERATURE.

The Materials of Construction. A Treatise for Engineers on the Strength of Engineering Materials. By J. B. JOHNSON, Professor of Civil Engineering in Washington University, St. Louis, Mo. New York, John Wiley & Sons. 1897. 8vo. Cloth. Pp. xv+787, with 9 plates. Price $6.00.

This work is divided into four parts, the first treating of the mechanics of the subject, the second of general properties of materials, the third of methods of testing, and the fourth of results of tests. The number of pages in these

several parts is 86, 215, 167 and 254, the remaining 65 pages being devoted to an appendix and index. Although mainly designed for engineers, it will be useful to physicists and to all who have to do with the mechanic arts, for a large part of the information that it gives can be found in no other book. The task of the author in sifting and discussing the vast number of tests on record was a difficult one, but it has been performed with skill and success.

Part I is somewhat disappointing in that it is, in the main, occupied with elementary matter regarding bars and beams which is found in all text-books on the resistance of materials. In an advanced work of this kind the engineer or physicist would naturally expect to find the mathematical theory of elasticity developed to a point in advance of that taught in technical schools, and especially to see the theory of true internal stress in beams set forth. A valuable discussion regarding the elastic limit is here given, and the results of very recent theoretic investigations of combined concrete and iron beams are presented.

Part II, although perhaps giving a fuller account of the manufacture and properties of materials than other general works on construction, has not been prepared with the best care and discrimination. For instance, the blast furnace is not mentioned, although 14 pages on the manufacture of cast iron is quoted from a British book on metallurgy. The chapter on timber, which fills 97 pages, is a reprint from a bulletin of the United States Forestry Bureau, and much of this might have been well omitted altogether, while the remainder should have been properly digested and condensed. Steel, cement and paving brick are discussed, however, in a very clear and concise manner.

Part III presents a more complete account of testing machines and methods of testing than can be found elsewhere in book form. The classification and discussions are here most excellent, and the presentation of conclusions of the European commissions on the question of standard specimens and methods is very complete. Static tests of tension and flexure naturally receive the greatest share of attention. Impact tests, with the exception of the cold-bend and drifting methods, seem inadequately treated in view of their growing use and importance; for instance, the flexural test of steel rails by a falling ram, where deflections and the elongations on the tensile side are measured, has long been used in Europe and during the past five years has been adopted by some of our leading railroads, and hence should have received at least brief notice.

Part IV gives an admirable digest of the results of experiments on materials. A most excellent feature, and one which indeed runs throughout the entire book, is the presentation of results by means of diagrams. These set forth the relations between the different properties of materials far more clearly than columns of figures can do and enable the reader to make comparisons which otherwise would be difficult or impossible for him to undertake. The tests which are discussed are, in the main, those precise and comprehensive ones made on metals during the past twenty years by Bauschinger, Tetmajer, the French commission, and by Howard at the Watertown arsenal, and those by the author on timber. Lack of space forbids a mention of the conclusions and results here recorded, but it should be said that the care exercised in selecting the data and the admirable method of presentation is alone sufficient to render the book an authoritative one.

The proper definition of the term 'elastic limit' has long been a puzzling question. While generally defined as the limit at which Hooke's law of proportionality of stress to deformation fails to hold good, it has also been explained to be characterized by the beginning of the permanent set, while in commercial tests the so-called yield point, where a sudden molecular change occurs, is generally regarded as the elastic limit. The author discusses these definitions at length, and proposes that the term 'apparent elastic limit' be used to indicate that point where the rate of elongation is fifty per cent. greater than the rate at the beginning of the elongation. This definition enables the elastic limit to be readily marked on a stress diagram, and for ductile materials it appears to locate a characteristic point which lies higher than the limit of elastic proportionality and lower than the yield point. The new definition, although defective in not referring

to a definite physical phenomenon, has some practical advantages, and it will doubtless receive extended notice and discussion by engineers. An authoritative definition of elastic limit will probably be established in time by the international association recently established for the study and unification of methods of testing.

The author lays much stress upon the method of judging the quality of a material by means of the work required to rupture it, or by its resilience, as Thomas Young called it in 1803. The diagram of a tensile test enables this work to be computed, and undoubtedly too great attention has heretofore been paid to the ultimate elongation and too little to the ultimate resilience. The elongation depends upon the form and length of the specimen and is far from being an absolute measure of the ductility; moreover that part of it which occurs after the maximum strength is reached is of doubtful value in estimating the work of rupture. It is for these reasons that percentage of reduction of area is extensively used in commercial tests, it being found to be nearly independent of the length of the specimen and hence a better index of ductility. In this direction of investigation great advances are to be expected, and the development of impact tests now in progress really results from the desire for a better determination of the ultimate resilience than the static stress diagrams can give. If all tests of metals except one were to be abandoned, the simple test of bending a cold bar by blows of a hammer would, by an overwhelming majority of votes, be the one to be retained; further, if this cold-bend test be made by a single blow, and if the changes of length on the tensile and compressive order be measured, a determination of both resilience and ductility is obtained, which, though not an absolute one, is probably as valuable as that given by the common static tension test. For these reasons it is thought that the author has somewhat overestimated the value of the ultimate elongation as determined on testing machines, and that reliance upon it as an absolute measure of ductility is generally too high.

The space devoted to the different materials is about as follows: 124 pages on timber, 43 on brick and stone, 77 on cement and mortar, 43 on cast iron, 24 on wrought iron, 87 on steel, and 18 on alloys. A timely chapter on the magnetic testing of iron and steel, by W. A. Layman, concludes the book. There are over 600 illustrations, of which about one-half are the valuable graphic representations and comparisons. From the extended experience of the author in laboratory work, and from his record as a writer and investigator, it was to have been expected that this book would be an excellent one. It has, however, more than realized the expectations in its Parts III and IV, for here are presented such careful and comprehensive analyses of modern methods and results that the book must at once take high rank as one of the standard authorities on the materials of engineering.

MANSFIELD MERRIMAN.
LEHIGH UNIVERSITY, June 1, 1897.

Experimental Morphology. Part I. By. Dr. C. B. DAVENPORT. The Macmillan Company. 1897.

The broadening of the biological horizon in recent years has necessitated an ever-increasing specialization on the part of investigators in that department of science. The territory now open to study is so extensive that it is beyond the powers of any individual to examine all parts of it in detail, and, consequently, each must choose for himself a portion of greater or less extent with which he may expect to become tolerably familiar. And yet it is impossible to reap the full benefits of results so obtained unless they can be correlated with what is being accomplished in adjacent fields, and, that his work may approach the ideal condition of being *totus teres atque rotundus*, the investigator of to-day must look to his neighbors to supply him from time to time with statements of what they have accomplished. Dr. Davenport's work on Experimental Morphology aims to be a statement of this kind, its object being to review what has been accomplished in the study of the extrinsic forces which determine the course of the development of organisms. The work, as projected, is to consist of four parts, of which the first, now before us, treats of the action of external forces, chemical and physical, on living protoplasm in general, while

the other three will consider their influence on growth, cell-division and differentiation.

If the first part is to be regarded as an earnest of what is to come, all biologists will look forward with interest to the completion of the work. The present part gives in successive chapters admirable and thorough accounts of the various observations and experiments on the action on living protoplasm of chemical agents, moisture, density, molar agents, gravity, electricity, light and heat, and concludes with an all too brief chapter discussing the light thrown by these observations on the structure of protoplasm, the conditions which limit metabolism, the dependence of protoplasmic movement on external stimuli and on metabolism and on the determination of the direction of locomotion. The action of each force is considered under several headings; light, for example, being considered as to its chemical action, its effect on the general functions of the organism and its action in controlling the locomotion (phototaxis); and the text is illustrated by numerous well-chosen figures as well as by several tables of which there may be especially mentioned No. XVIII., which gives the nature of the response to light of the various forms which have been experimented upon in this connection; No. XIX., which gives the ultramaximum temperature for numerous organisms; No. XX., which similarly gives the ultraminimal temperatures, and No. XXI., which is a list of species found in Hot Springs with the conditions under which they occur. The author's judgment in the treatment of his subject is excellent, as he has confined himself for the most part to a judicious statement of facts and phenomena, with here and there a suggestive inference or an indication of lines for further observation, wisely refraining from what would have been more or less profitless discussions, the times not yet being ripe for broad generalizations on the subjects of which he treats. The material which is discussed has been well digested and is well arranged, and the style, though retaining here and there somewhat of the flavor of the note-book, is on the whole clear and concise. The book is a readable one, and the descriptions and criticisms of methods employed in experimentation, and the bibliographical lists at the conclusion of each chapter, contribute materially to the value the book possesses for both the morphologist and the physiologist.

It is a question, however, if the title chosen for the work is applicable so far as the first part is concerned. The action of poisons, heat, light and electricity on protoplasm, chemotaxis, rheotaxis, geotaxis and similar phenomena, as well as those of acclimatization to various chemical and physical forces, can hardly be considered as falling within the domain of morphology. They are undoubtedly physiological questions. Indeed, the ground which Dr. Davenport here covers is discussed by Verworn, in a somewhat more general manner, in the fifth chapter of his *Allgemeine Physiologie*. Nevertheless, the questions discussed are of the highest interest to morphologists, and Dr. Davenport has placed his *confrères* under great obligations by placing in their hands so lucid an exposition of that side of physiology which especially appeals to them.

Owing to the careful thoroughness with which Dr. Davenport has labored, the work is comparatively free from oversights. It is to be regretted, however, that the author has seen fit to confine his attention almost exclusively to organisms as a whole, to the neglect of considerable valuable information to be derived from observations on vertebrate tissues. The action of poisons, for example, on the peculiarly unstable protoplasm of the vertebrate nervous system is hardly treated with the fullness which its interest and importance demand, and insufficient attention is given to the numerous results of general significance which have been obtained by the study of electrical stimulation of muscle and nerve protoplasm. We miss, too, a discussion of the effects of surface tension in producing movements of protoplasm, a question which has been considered by Ryder in several publications. A few typographical errors are noticeable, though none are serious, but a great defect consists in the absence of an index, a defect which may be remedied in the concluding volume. A separate index for each part would, however, be a great convenience.

J. P. McMurrich.

University of Michigan, May 23, 1897.

SCIENTIFIC JOURNALS.

JOURNAL OF GEOLOGY, MAY–JUNE, 1897.

UNDER the title 'The Last Great Baltic Glacier,' Dr. James Geikie replies to the recent criticism by Dr. Keilhack.* He gives a brief re-statement of the evidence presented in the *Great Ice Age* for the belief that the great terminal moraines of the Baltic Ridge are products of an independent glacial epoch, quoting Du Pasquier on disputed points.

The post-Pleistocene elevation of the Inyo range and the Waucobe lake beds of California are discussed by C. D. Walcott. A series of well characterized lake beds in the foot hills of the Sierra Nevada are described. The beds contain fossils any of which 'might be recent or Pliocene' as determined by Dall, but of which the probable age is believed to be Pleistocene. The beds have a maximum thickness of 150 feet and in character resemble the ancient sediments of Lake Lahontan. The strata lie at very different levels. There is evidence of faulting and it is believed that there has been recent elevation to the amount of about 3,000 feet. In this connection the Owen Valley earthquake of 1872 is recalled.

In the fifth of his Italian Petrological Sketches, Dr. Henry S. Washington gives a general summary. The composition of the rocks of the Ciminite-Vulsinite-Toscanite series is discussed and its relationships to the Absorakite-Shoshonite-Banakite series as well as to other intermediate groups is illustrated by analyses and tables. The trachydolerites and the leucitic rocks are also discussed as to composition and relationship.

Dr. H. F. Reid gives a summary of the first annual report of the International Committee on Glaciers. Under each country notes relative to the present phase of glaciation is given. Of the Alpine glaciers a considerable number show the phase of increase. In America the glaciers are in general retreating, though some show the contrary phase. In 1896 the glaciers of Cook's Inlet, Chilcat Pass, and the Glacier Bay region, as well as those of Mt. Ranier, Mt. Hood and the Selkirk mountains were all reported as decreasing.

Jour. Geol., V., 113–125.

A sketch of the Geology of Mexico, based upon the recently issued reports of the Geological Institution of Mexico, is presented by Mr. H. F. Bain.

Among the reviews is an extended discussion, by Mr. C. F. Tolman, of the recent papers by Dr. G. F. Becker on rock differentiation.*

SOCIETIES AND ACADEMIES.

TORREY BOTANICAL CLUB, WEDNESDAY, APRIL 28, 1897.

PROFESSOR L. M. UNDERWOOD, Chairman, Professor N. L. Britton, Secretary, *pro tem.*

The first paper was by Professor L. M. Underwood, 'Notes on the Ferns of Japan.'

The immediate occasion of this paper was the receipt during the past year of two separate collections of Japanese ferns of about 50 species each.

The insular position of Japan, together with a considerable range of latitude, equalling that from St. Paul, Minn., to Mobile, Ala., gives Japan a larger proportion of ferns than we have in the United States, although the area of the islands is only that of the northeastern States as far as the Virginias, together with about one-half of Ohio.

The ferns are those of temperate climates and agree well with those of the adjacent mainland so far as the latter are known. A few subtropical forms enter the flora, but the really tropical species do not reach the islands.

Many species are common inhabitants of Europe as well as the eastern United States, but the ferns of Japan offer very little support to the once prevalent notion of the great similarity to the flora of the eastern United States. In fact about as many Japanese species have as many near allies in Pacific America as in other portions of the country if we exclude the species quite generally distributed through the north temperate zone.

Discussing the paper, Professor Britton cited a number of instances among spermatophytes, in which species supposed to be common to Japan and eastern North America had been

Amer. Jour. Sci. (4), Vol. III., pp. 21–40, Jan., 1897.

shown to be distinct. He maintained that the theory of migration, as ordinarily accepted, was insufficient to account for such similiarity between the floras of the two regions as actually exists. Mr. T. H. Kearney, Jr., remarked that in comparing the grass-flora of the two regions he had found that, exclusive of circumboreal species, only two species are in common.

The second paper was by P. A. Rydberg, entitled 'Floral Features of Western Nebraska.'

It is a popular misconception that the country from Illinois to the Rocky Mountains constitutes one undifferentiated region. In fact, there are two entirely different regions, viz: 1. The prairie region, with rich loam and a comparatively good supply of rain and extending into the eastern Dakotas, Nebraska and Kansas. 2. The region of the Great Plains, with dry, hard soil and scanty rainfall and comprising the western portion of said States, eastern Colorado and Montana and the larger portion of Wyoming.

The plains are mostly covered by short grasses, the so-called Buffalo grasses. In the hot, dry autumn these become self-cured and form an excellent winter pasture for the stack. A little hay is cut on the lowlands and fed to the animals during snow storms. Otherwise the cattle and horses feed out during the whole winter. The Buffalo grasses are: the original Buffalo grass, *Bulbilis dactyloides;* Blue and Black Grama, *Boutelova oligostacha* and *hirsuta*, and 'Nigger Heads,' *Carex filifolia.*

In a region where the rainfall is comparatively scant and distributed only during certain seasons of the year the plants must be so constituted as to be able to withstand a good deal of drought. In other words, the evaporation must either be reduced to a minimum or the plant must have special stores of water. The plants peculiar to this region may be divided into the following groups:

1. Very hairy plants generally covered with thick pannose pubescence, which retain the moisture, as species of *Eriogonum*, *Astragalus*, *Eurotia*, *Senecio*, *Evolvulus* and *Artemisia.*

2. Plants with glaucous foliage having a hard epidermis, as *Yucca glauca*, *Rumex venosus*, *Argemone alba* and several grasses.

3. Plants with white, often shreddy bark, as, species of *Mentzelia* and *Anogna.*

4. Plants with very narrow and often involute leaves, as *Lygodesmia juncea* and *rostrata*, and several grasses and sedges.

5. Plants with fleshy stems in which the surface is reduced to a minimum and no leaves, as the Cacti.

6. Plants with a deep-seated, enlarged root as the Bush Morning Glory, *Ipomœa leptophylla*, and the wild pumpkin, *Cucurbita fœtidissima.* Mr. Rydberg had seen a root of the former three feet long and almost two feet in diameter.

7. Plants covered with glands, containing essential oils, as *Dysodia papposa* and *Pectis angustifolia.* The oil is supposed by some to have a cooling effect, partly by taking up heat when evaporated and partly by surrounding the plant by a cooler atmosphere, their specific heat being much less than the air.

Two papers followed by Dr. J. K. Small: (a) 'The Sessile-flowered *Trillia* of the Southern States,' (b) 'Notes on Epilobiaceæ.' Both papers are published in the April number of the *Bulletin.*

N. L. Britton,
Secretary pro tem.

Alabama Industrial and Scientific Society.

The annual meeting of this society was held in the city of Birmingham on the 18th instant.

Mr. W. M. Brewer read a paper on Copper Mining in Alabama, in which he stated that the old Woods copper mine in Cleburne county had recently been taken in hand by a company which was doing a large amount of work in raising the ore, which is a copper-bearing pyrrhotite.

Mr. T. H. Aldrich gave an account of the work in which he has lately been engaged in preparing to mine and mill the gold-bearing quartz veins of Hog Mountain, in Tallapoosa county. This is a low-grade ore, but it can be mined and milled at a very small cost, and as the quantity is very great the proposed operations are to be on a large scale. In connection with this paper, the discussion brought out the fact that the working of similar low-grade ores has been very profitably carried on for about a year in the Idaho district, in Clay county, and Mr. Aldrich predicts that a number of gold-

mining plants will soon be in successful operation in the State. The recent reports of the State Geological Survey have shown that low-grade gold ores occur in large quantity at several localities in Alabama, and, since the success of the operations at Idaho has been fully demonstrated, the attention of capitalists has been directed to this inviting field.

Dr. Eugene A. Smith gave a short account of his recent visit to northwestern Texas for the purpose of inspecting again the sulphur deposits of that region. He exhibited some photographs taken by him which gave a good idea of the character of the scenery there.

Mr. Charles Geohegan gave to the Society some statistics concerning the relative cost of making mining engines and other mining machinery in Birmingham and in cities farther north.

Mr. J. W. Sibley read an instructive paper on the manufacture of vitrified brick, illustrating his remarks with a number of specimens of the crude material in various stages of its preparation and of the finished product. The material used in this manufacture is a gray shale, occurring in the Coal Measures of this State, in the vicinity of Coaldale, in Jefferson county.

Mr. Brewer then gave a report upon his success in the collection of the statistics of mineral production in Alabama, under the auspices of the State Geological Survey and this Society. He announced that for the past month he had succeeded in collecting statistics of about 95% of the total production, and said that he hoped to be able to have complete returns in the course of a few months. The statistics are collected monthly and sent out to the technical journals of the country and to the leading newspapers of the State.

Mr. Paschal Shook made the statement that the Birmingham Steel Mill Company were building two forty-ton basic open-hearth furnaces, which would probably be finished in the course of two months. They expect to be able to furnish steel billets to all the rolling mills of this section.

In his address the retiring President, Mr. F. M. Jackson, urged upon the members of the Society to exert themselves to increase the membership and with it the influence for good of this Society.

Officers for the ensuing year were elected as follows: President, Truman H. Aldrich, of Birmingham; Vice-Presidents, J. W. Minor, of Thomas, and J. A. Montgomery, of Birmingham.

EUGENE A. SMITH,
Secretary.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 264th regular meeting of the Society was held Tuesday, May 18, 1897. Professor Otis T. Mason exhibited a peculiar shaped boat from the Kootenay river, which in bow and stern was not unlike the modern ram or monitor, having a double point under water. The little model had been in the Smithsonian for forty years and was said to be an exact representation of the boats in use along certain parts of the Columbia river. It is made of the whole skin of the pine tree, and thus differs from the birch-bark canoe, which is made of pieces. This is reversed, so that the bast is outside and the bark inside; the ends are then drawn together and cut obliquely or with a slight curve from above downward, causing the bottom to project at either extremity, forming a point.

A line drawn across the Mercator map to Asia will strike the Amoor river, where practically the same style of boat is found, and the question was raised whether it showed contact or independent origin, and from the great resemblance it was thought the former, showing the migration of canoe forms from Asia to America.

Professor Mason premised these remarks by an outline upon the evolution of the boat. In the study of progress, water travel divides itself into *flotation* and navigation, the former meaning simply keeping above the surface, the latter including the higher problem of movement in a determined direction. Navigation includes the two elements of the hull and of the mechanism of movement. Propulsion may thus be represented:

Propulsion { Muscular, man or beast, { as in swimming, poling, paddling, rowing or cordeling.
Physical { wind, sail, steam and electricity.

The types of American aboriginal boats as conditioned by exigencies were then considered, beginning at the extreme north:

Kyack, or swift flying or man's boat for seal hunting. Umack, or scow or woman's boat for transportation.

Canada and northern United States, birch canoe, Haida.

Lower down on Pacific coast, Dugout, Klinkit, Chinook.

Inland, Columbia river, Kootenay.

Missouri river, Bull boat, which is nothing but a sort of crate with bull hide over it and pulled by a rawhide line, *i. e.*, towed.

South in East, Pirogue or dugout of soft log.

South and West, reed float or raft, reed catamaran.

On Pacific side of South America, Balsa.

In the interior and southward, woodskin.

The forms of boats are products of several causes or exigencies cooperating. The exigency of water is the study of the kind of water and its conduct, and the natives have everywhere studied the nature of water. The craft has resulted by a sort of natural selection. Thus at the mouth of the Yukon river the kyack is decked over with seal skin to keep off the spray; farther up the river is a birch-bark kyack partially decked; while still above it is an open birch canoe with no decking, on account of the rapids.

Exigency No. 2. Material, thus no Sioux made a boat of log, because there are no logs in his country, but have buffalo hide, and the propulsion is by women swimming, drawing the craft with a line.

Exigency No. 3. Function or use of boat. Thus for its purpose of swiftness the Esquiman kyack is built on the same lines as the best racing shells.

Exigency No. 4. Ethnic genius or the particular way or style of making by a people or tribe.

Discussed by Messrs Hough, Stetson, Sternberg, Pierce and McCormick.

Mr. Wells M. Sawyer read a paper on 'Jodocus Hondius Illustrations,' and exhibited one of the early maps of North America, 1607, containing many curious illustrations.

The principal of these is one in the lower left-hand corner of the sheet, showing 13 Indians from Brazil preparing a favorite intoxicant. The costuming, form of vessels and details of manipulation are truthfully given; to the right is a group of women biting and chewing the root which they afterwards spit into the large bowl from which others are pouring into an olla around which a fire is burning. Each illustration is accompanied by a Latin inscription of explanation. Another illustration of interest to the anthropologist is the throwing stick.

Discussed by Messrs Mason, Flint, Pierce, McGee and Sawyer.

Mr. James H. Blodgett read a paper on the 'Weak Places in our Public Education,' devoting the subject-matter principally to the study of geography in the public schools; he presented a number of old atlases, ranging from 100 to 20 years old and showing what slight changes had been made in the books used in 1820 and those used to-day and the unfitness of the latter for use with our present knowledge of such things.

Discussed by Messrs Flint and McCormick.

Professor W J McGee gave a paper on 'Present Condition of the Muskwaki Indians.' These Indians, known as the Sac and Fox, were at one time independent tribes near the Atlantic, but confederated for the purpose of warring against the Sioux; the Sac furnishing the principal chiefs up to the time of the Black Hawk War. They then moved to Iowa and bought land, and vested the title in the Governor of the State in trust, *ex-officio*, and now have about 3,000 acres. Their condition is quite primitive, and they are what are termed blanket and moccasin Indians.

They build winter and summer houses, the former ellipsoid in form, covered with mats made of rushes, sewed with cord manufactured by themselves; the summer house is rectangular, covered with the bark of the basswood or linden.

There is a symbolism connected with the building of their houses. They have many curious beliefs.

Discussed by Mr. Chas. Moore.

The Society adjourned for the summer.

J. H. McCormick,
General Secretary.